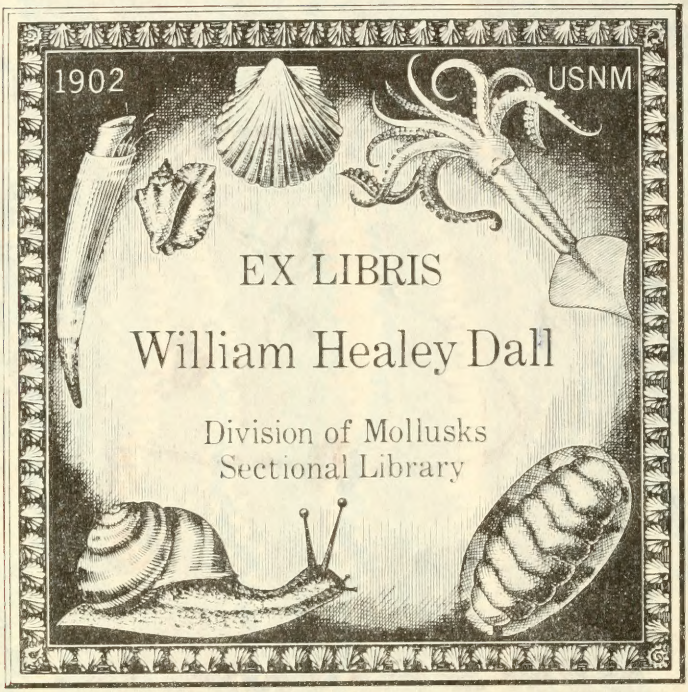
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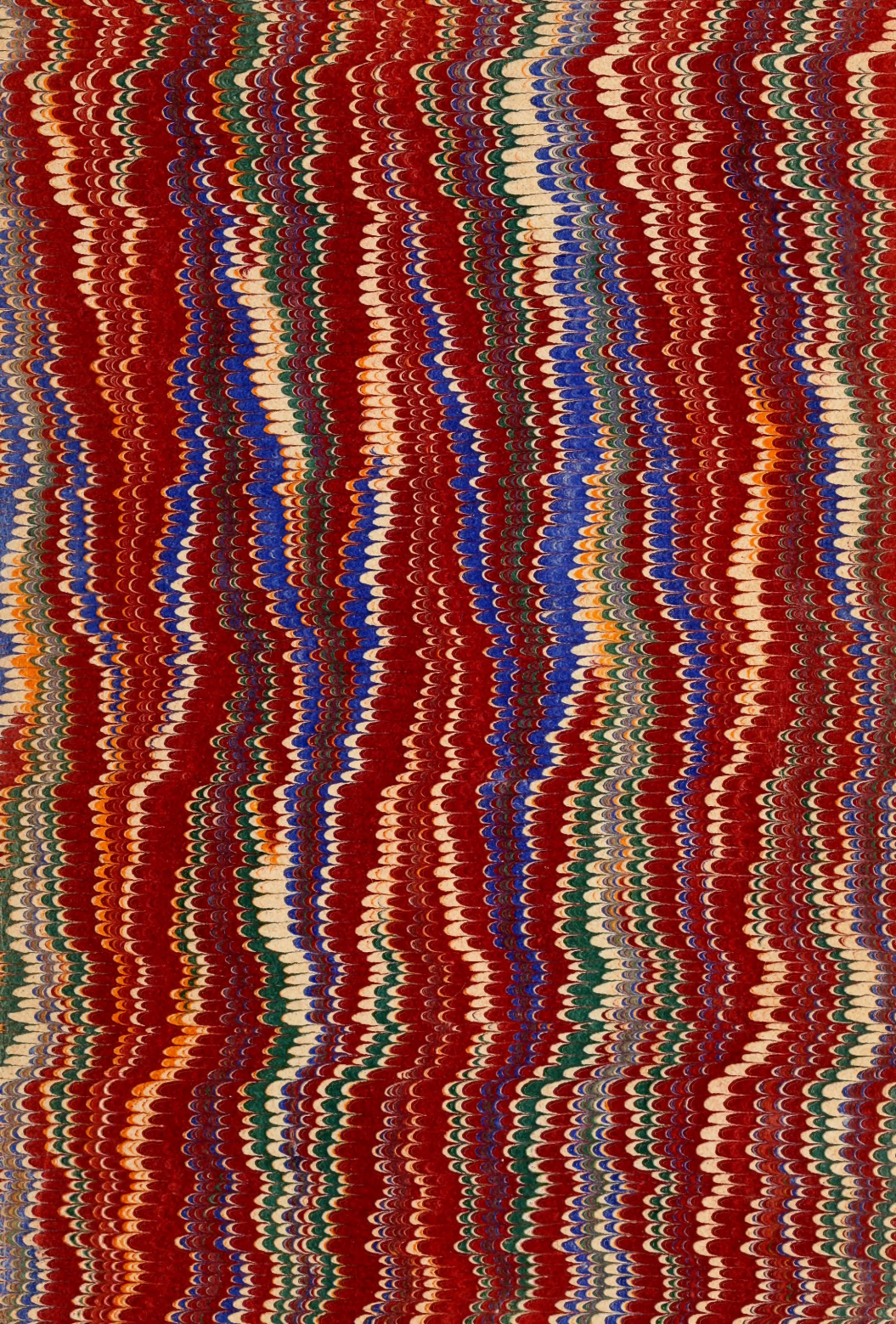

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THE

JOURNAL OF MALACOLOGY.

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DESCRIPTIONS OF NEW SPECIES OF MARINE SHELLS FROM CEYLON.

By H. B. PRESTON, F.Z.S.

(Plates i and ii.)

The species forming the subject matter of the present paper were included in that portion of the collection of the late Mr. Hugh Nevill, which was secured by me after its recent disposal; this collection was especially rich in material from Ceylon, and I have every reason to believe that all the species now in question were collected in that island.

Tornatina tenuistriata, n. sp.

Pl. i, figs. 1—1a.

Shell elongate cylindrical, spire conical, semipellucid, white, protoconch sinistral and turned upon its side; whorls 3, exclusive of the protoconch, very finely spirally striate; suture deeply channelled; aperture elongate, narrow above, dilated at the base; peristome thin, somewhat contracted towards the centre, slightly expanding outwards at the base; columella descending in a curve and bearing a single plait.

Alt. 4. 5 millim.; diam. maj. 1.5. Aperture, alt. 3 millim.; diam. maj. .5.

Hab.—Ceylon.

Retusa serendibensis, n. sp.

Pl. i, fig. 2.

Shell cylindrical, semipellucid, marked longitudinally with somewhat opaque lines of growth, and finely spirally striate throughout; aperture curved, narrow above, dilated at the base; peristome rounded above and produced beyond the apex, slightly contracted in the middle; columella descending in a curve.

Alt. (including outer lip) 3 millim.; diam. maj. 1.25. Aperture, alt. 3 millim.; diam. maj. .5.

Hab.—Ceylon.

Clavatula gaylordae, n. sp.

Pl. i, fig. 3.

Shell fusiform, brown; whorls 9, the first three smooth, the remainder bearing coarse costae interrupted by spiral striae; the costae on the body whorl becoming obsolete below the periphery; sutural coronal well defined; aperture oval; peristome thin; columella slightly curved outwards.

Alt. 6 millim.; diam. maj. 2. Aperture, alt. 2 millim.; diam. .75.

Hab.—Ceylon.

Mangilia mangeri, n. sp.

Pl. i, fig. 4.

Shell slenderly fusiform, dirty white, stained with patches of pale brown, a broad band of the same colour appearing round the base of the shell; whorls 6, somewhat finely cancellated, the upper whorls bearing a central row of rather coarse tubercles; suture impressed; aperture elongate oblong oval; peristome thickened; columella rather straight.

Alt. 8.5 millim.; diam. maj. 3. Aperture, alt. 3 millim.; diam. 1.

Hab.—Ceylon.

Mangilia (Glyphostoma) cazioti, n. sp.

Pl. i, fig. 5.

Shell ovate fusiform, the upper whorls flesh colour, the two last white, a pale brown band appearing at the base of the body-whorl while the suture is also discoloured by a faint band of the same colour; whorls 5—6, sculptured with spiral striae and coarse, somewhat distant, transverse ribs which project above the suture; suture impressed; aperture narrow, oblique; peristome thickened and serrated by the spiral striae; columella descending obliquely.

Alt. 5 millim.; diam. maj. 2.25. Aperture, alt. 2 millim.; diam. .5.

Hab.—Ceylon.

Mangilia (Glyphostoma) ecolorata, n. sp.

Pl. i, fig. 6.

Shell oblong fusiform, white; whorls 6—7, shouldered, cancellate with coarse costae and spiral striae; suture well impressed; aperture curved, elongate; peristome thickened and serrated on the inner margin; columella curved.

Alt. 7.7 millim.; diam. maj. 2.5. Aperture, alt. 2.5 millim.; diam. .5.

Hab.—Ceylon.

Mangilia (Clathurella) carnicolor, n. sp.

Pl. i, fig. 7.

Shell ovate, white, bearing two broad flesh-coloured bands, one above, and one below the periphery; whorls 7, cancellated with fine costae crossed by spiral striae, the penultimate whorl rather swollen, the apical whorls acute; aperture oblong oval; peristome thickened and serrated by the spiral striae; columella descending in a slight curve.

Alt. 5 millim.; diam. maj. 2. Aperture, alt. 2 millim.; diam. .5.

Hab.—Ceylon.

This species somewhat recalls *C. bulleni*, Preston*, but is easily distinguished by the pale flesh-coloured bands and by its being much more finely sculptured than is the case with *C. bulleni*.

Mangilia (Cythara) brunneolineata, n. sp.

Pl. i, fig. 8.

Shell ovate fusiform, yellowish-white, painted with fine thread-like pale reddish brown spiral lines, and bearing two blotches of the same colour on the body whorl, one just behind the sinus, and the other at the base of the outer lip; whorls 7—8, obliquely costate and finely spirally striate; suture well impressed; aperture narrow, elongate oval; peristome varicosely thickened; columella slightly curved.

Alt. 5 millim.; diam. maj. 2. Aperture, alt. 2 millim.; diam. .5.

Hab.—Ceylon.

Cancellaria exquisita, n. sp.

Pl. i, fig. 9.

Shell thin, ovately turreted, very narrowly perforate, pale reddish-brown, encircled just below the periphery by a white band; whorls 7—8, somewhat convex sculptured with coarse spiral and transverse striae, presenting a cancellated appearance and bearing occasional varices at irregular intervals, the apices of which are pure white and project above the suture; suture deeply channelled; aperture inversely auriform; peristome varicosely thickened; columella rather straight, three plaited and extending into a thin callosity which reaches the lip above.

Alt. 19 millim.; diam. maj. .9. Aperture, alt. 8 millim.; diam. 3.5.

Hab.—Ceylon.

Columbella (Mitrella) multistriata, n. sp.

Pl. i, fig. 10.

Shell fusiform, pale whitish; whorls 8—9, sculptured throughout with very fine spiral striae and with indistinct, transverse, undulating ridges which are slightly more distinct on the upper whorls; suture shallow and slightly crenulate; peristome somewhat varicosely thickened and expanded downwards towards the centre; columellar decending in a curve, a thick callosity joining it with the lip above; aperture elongately oval; canal short and rather broad.

Alt. 7.5 millim.; diam. maj. 2.75. Aperture, alt. 2 millim.; diam. .75.

Hab.—Ceylon.

Cerithium tomlini, n. sp.

Pl. i, figs. 11—11a.

Shell elongate fusiform, varicose, reddish brown throughout except the varices which are white; apex acute; whorls 10, rather convex, sculptured with transverse costae becoming obsolete on the last half of the body whorl and which are crossed by fine spiral striae; suture impressed; peristome thin; columellar straight; canal short and curved very slightly outwards; aperture oval.

* Journ. of Malac., 1904, vol. xi, p. 75.

Alt. 3.75 millim ; diam. maj. 1.25. Aperture, alt. .5 millim. ; diam. .25.
Hab.—Ceylon.

Cerithiopsis abjecta, n. sp.

Pl. i, figs. 12—12a.

Shell elongate fusiform, light brown, a broad band of darker brown appearing below the suture, apex rather blunt; whorls 8, somewhat flattened, sculptured with three spiral ridges intersected by deep transverse grooves giving the shell a beaded appearance ; suture impressed ; aperture rotundly ovate ; columella descending truncate below and extending into a callosity which reaches the lip above ; peristome simple.

Alt. 2 millim ; diam. maj. .75.
Hab.—Ceylon.

Cerithiopsis brunneoflavida, n. sp.

Pl. i, fig. 13.

Shell elongate turriform, bright brownish yellow ; whorls 11—12, sculptured with three somewhat distant revolving lirae intersected by fine transverse striae presenting a coarsely punctate appearance ; suture impressed ; aperture rotundly ovate ; columella curved and truncate below

Alt. 8 millim. ; diam. maj. 2.25. Aperture, alt. 1 millim. ; diam. .75.
Hab.—Ceylon.

Cerithiopsis orientalis, n. sp.

Pl. i, figs. 14 – 14a.

Shell elongate, yellowish white ; whorls 14—15, sculptured with three closely set coarse spiral lirae, interrupted by transverse grooves giving the shell a a beaded appearance ; suture deeply impressed ; aperture rotundly ovate ; columella descending in a slight curve, truncate below.

Alt. 8 millim. ; diam. maj. 1.75. Aperture, alt. .25 millim.
Hab —Ceylon.

Diala polita, n. sp.

Pl. i, fig. 15.

Shell elongate pyramidal, imperforate, thin, polished, yellowish ; whorls 8, the last spirally striate, the striae becoming much coarser below the periphery ; suture impressed ; peristome simple ; aperture oval.

Alt. 4.5 millim. ; diam. maj. 1.75. Aperture, alt. 1 millim.
Hab. – Ceylon.

Diala semipellucida, n. sp.

Pl. i, fig. 16.

Shell elongate pyramidal, subperforate, shining white, somewhat pellucid, a narrow opaque white band appearing below the sutures ; whorls 8—9, rather flattened, sculptured throughout with very fine spiral striae, the last whorl keeled below the periphery ; suture impressed ; aperture oval ; peristome thin ; columella rather straight and extending into a callosity joining the lip above.

Alt. 5.5. millim. ; diam. maj. 2. Aperture, alt. 1.5 millim. ; diam. .5.
Hab.—Ceylon.

Rissoina pellucida, n. sp.

Pl. i. fig. 17.

Shell ovately fusiform, imperforate, thin, white, transparent ; whorls 4—5, smooth, rather polished ; suture scarcely impressed ; peristome simple ; aperture oval.

Alt. 1.5 millim. ; diam. maj. .5.
Hab.—Ceylon.

Rissoina delicatula, n. sp.

Pl. i, figs. 18—18a.

Shell elongate fusiform, white, whorls 7—8, sculptured with numerous very fine tranverse costae gradually disappearing on the last half of the body whorl which is finely spirally striate ; suture linear ; peristome somewhat varicosely thickened ; columella slightly notched below ; aperture inversely auriform.

Alt. 6 millim. ; diam. maj. 2.25. Aperture, alt. 1.5 millim. ; diam .75.
Hab.—Celyon.

Rissoina oscitans, n. sp.

Pl. i, figs. 19—19a.

Shell elongate subcylindrical, thin, transparent white ; whorls 6 —7, very finely spirally striate ; suture impressed ; peristome slightly thickened ; aperture broad, dilated, ovate ; columella descending somewhat obliquely below and extending into a callosity which reaches the lip above.

Alt. 5.75 millim. ; diam. maj. 1.5. Aperture, alt. 1.5 millim ; diam. .5.
Hab.—Ceylon.

Rissoina (Rissolina) filicostata, n. sp.

Pl. i, fig. 20.

Shell elongate pyramidal, white, whorls 8—9, sculptured with somewhat fine oblique costae becoming obsolete on the last half of the body-whorl, and finely spirally striate throughout, the spiral striae becoming stonger in that region where the costae are obsolete ; suture impressed ; peristome varicosely thickened ; aperture oval ; columella notched and much twisted at the base.

Alt. 5.5 millim ; diam. maj. 2. Aperture, alt. 2 millim. ; diam. .75.
Hab.—Ceylon.

Rissoina (Morchiella) lankaensis, n. sp.

Pl. i. fig. 21.

Shell elongate fusiform, yellowish-white ; whorls 10, the first seven coarsely sculptured with spiral lirae crossed by transverse grooves, presenting a beaded appearance, the lower whorls smooth ; suture deeply impressed above, linear below ; peristome thickened interiorly ; columella slightly notched below ; aperture inversely auriform.

Alt. 10 millim. ; diam. maj. 3.5. Aperture, alt. 2 millim. ; diam. .75.
Hab.—Ceylon.

Fenella purpureoapicata, n. sp.

Pl. i, fig. 22.

Shell elongate fusiform, yellowish-white, the apical whorls tinged with blackish

purple; whorls 10, somewhat inflated, transversely costate, the costae becoming much weaker on the body whorl and only reaching to the periphery, spirally striate giving the shell a cancellated appearance; suture impressed, crenulate; peristome simple; aperture oval.

Alt. 4 millim.; diam. maj. 1.25. Aperture, alt. .5

Hab.—Ceylon.

Eulima exasperata, n. sp.

Pl. ii, fig. 23.

Shell elongately fusiform, dirty-white; somewhat pellucid; whorls 10, smooth, shining, rather flat, the apical whorls slightly curved; suture impressed; peristome simple; aperture oval.

Alt. 3 millim.; diam. maj. 1. Aperture, alt. .5 millim.

Hab.—Ceylon.

Eulima indica, n. sp.

Pl. i, fig. 24.

Shell elongate fusiform, very solid, smooth, polished, milky-white; whorls 12, flattened; suture impressed; aperture oval; columella curved.

Alt. 6 millim.; diam. maj. 2. Aperture, alt. 1.5 millim.; diam. .5.

Hab.—Ceylon.

Pyramidella (Oscilla) mirabilis, n. sp.

Pl. ii, fig 25.

Shell elongate fusiform, thin, dirty-white; whorls 6—7, channelled, spirally lirate, the upper whorls bearing a thick, smooth, annular spiral ridge just below the suture and two coarse spiral lirae below this ridge; suture impressed; aperture oval; peristome simple, curved inwards at the point where it reaches the channelled portion of the whorl; columella somewhat arched and bearing a single plait.

Alt. 4 millim.; diam. maj. 1 5. Aperture, alt. .5 millim.

Hab.—Galle, Ceylon.

Pyramidella (Oscilla) suburbana, n. sp.

Pl. ii, fig. 26.

Shell elongate fusiform, pale brownish-yellow; whorls 7—8, rather flattened, sculptured with three spiral lirae on the middle whorls increasing to seven on the body-whorl; peristome simple; aperture ovate; columella arched and expanded outwards below, bearing a strong plait above.

Alt. 3.5 millim.; diam. maj. 1.5. Aperture, alt .5 millim.

Hab.—Kalpetti (a suburb of Colombo), Ceylon.

Pyramidella (Mormula) humilis, n. sp.

Pl ii, fig. 27.

Shell elongate fusiform, white; whorls 8 - 9, somewhat coarsely transversely costate and spirally striate giving the shell a finely cancellated appearance; suture impressed; peristome simple; aperture ovate; columella twisted.

Alt. 4.75 millim.; diam. maj. 1.5. Aperture, alt. .5 millim

Hab.—Ceylon.

Pyramidella (Actaeopyramis) ceylanica, n. sp.

Pl. ii, figs. 28—28a.

Shell elongate, white, thin, transparent; whorls 10—11, rather flattened, sculptured with opaque coarse spiral striae and finely cancellated by very fine transverse striae; suture well impressed; peristome simple; aperture oval, somewhat elongated; columella plait oblique.

Alt. 10 millim.; diam. maj. 2.25. Aperture, alt. 2 millim.; diam. 1.

Hab.—Kandakulli, Ceylon.

Pyramidella (Actaeopyramis) sykesi, n. sp.

Pl. ii, fig. 29.

Shell elongate, tapering, transparent white; whorls 8—9, flattened, sculptured with fine spiral grooves intersected by very fine transverse striae giving the surface of the shell an almost punctate appearance; suture impressed; peristome thin; aperture elongate oval; columella slightly curved.

Alt. 6 millim.; diam. maj. 1.5. Aperture, alt. 1.5 millim.; diam. .5.

Hab.—Ceylon.

Pyramidella (Actaeopyramis) suavissima, n. sp.

Pl. ii, fig. 30.

Shell elongate cylindrical, thin, white; whorls 7, spirally striate and cancellated by very fine transverse striae; suture deep; peristome simple; aperture oval.

Alt. 3.5 millim.; diam. maj. 1.25. Aperture, alt. .5 millim.

Hab.—Kandakulli, Ceylon.

Turbonilla coeni, n. sp.

Pl. ii, fig. 31.

Shell elongate, thin, dirty-white; whorls 12—13, flattened, closely costate; suture impressed; peristome simple; aperture oval; columella straight.

Alt. 5 millim.; diam. maj. .75. Aperture, alt. .25 millim.

Hab.—Kandakulli, Ceylon.

Turbonilla sinhila, n. sp.

Pl. ii, figs. 32—32a.

Shell elongate, whitish; whorls 10, costate, the costae on the last whorl much finer and more numerous than on the whorls above; suture well impressed; peristome simple; aperture oval; columella descending obliquely.

Alt. 3.75 millim.; diam. maj. 1.

Hab.—Kandakulli, Ceylon.

Turbonilla (?) princeps, n. sp.

Pl. ii, fig. 33.

Shell elongate fusiform, bright yellow, ornamented with a rich reddish-brown band just below the suture, and appearing on the body-whorl well below the periphery; whorls 10—11, flattened, very finely costate and bearing traces

of microscopic spiral striae; suture scarcely impressed; aperture auriform; columella fold fairly well developed.

Alt. 8 millim.; diam. maj. 2.25. Aperture, alt. 1.5 millim.; diam. .75.

Hab.—Ceylon.

Gena ziczac, n. sp.

Pl. ii, figs. 34a—34d.

Shell haliotoid, oval, polished, yellowish-pink, painted with zigzag flame markings and blotches of reddish-brown, and bearing a regular line of oblong dark-brown blotches at the periphery; whorls 3—4, sculptured with fine radiating lines of growth and spiral striae which become coarser at the base; interior of shell iridescent, the spiral striae showing very plainly; suture shallow; peristome simple; columella arcuate; aperture oblong ovate.

Alt. 9 millim.; diam. maj 5. Aperture, alt. 5.5 millim.; diam. 4.

Hab.—Ceylon.

Callista (Callocardia) birtsi, n. sp.

Pl. ii, fig. 35.

Shell rather thin, ovate, white, concentrically sculptured with fine regular striae; extremities of umbones tinged with very pale pink; anterior side produced; posterior side somewhat obtuse.

Alt. 28 millim.; length 34.5.

Hab.—Ceylon.

Cultellus (Ensiculus) maculatus, n. sp.

Pl. ii, fig. 36.

Shell thin, elongated, strongly curved, pale flesh-colour, irregularly blotched and spotted with white, and covered with a thin, brown, periostracum; anterior margin rounded and bent outwards; posterior margin somewhat obtuse.

Alt. 11 millim.; length 48.

Hab.—Ceylon.

Gastrana (Metis) bridgmani, n. sp.

Pl. ii, fig. 37.

Shell white, oblong ovate, sculptured with fine, concentric, rather irregular striae; left valve much depressed towards the centre, anteriorly flexuous; right valve less depressed; anterior side descending abruptly at an obtuse angle; posterior side rather attenuated, rounded, umbones small.

Alt. 25 millim.; length 29.5.

Hab.—Ceylon.

Anatina smithi, n. sp.

Pl. ii, fig. 38.

Shell elongate, thin, yellowish-white, concentrically striated with somewhat irregular lines of growth; anterior side slightly attenuated, rounded, gaping; posterior side rounded, moderately gaping.

Alt. 20 millim.; length 38.

Hab.—Ceylon.

DESCRIPTIONS OF TWO NEW SPECIES OF DIPLOMMATINA FROM CEYLON.

By H. B. PRESTON, F.Z.S.

(Plate ii, figs. 39, 40).

Diplommatina (Nicida) lankaensis, n. sp.

Pl. ii, fig. 39.

Shell dextral, pyramidal, somewhat transparent, pale horn colour; whorls 8, rather coarsely spirally striate throughout, the penultimate whorl being narrower than the antepenultimate; suture impressed; umbilicus broad; peristome continuous, slightly reflexed, reddish-brown, irregular; aperture subcircular.

Alt. 3 millim.; diam maj. 2. Aperture, alt. 1 millim.; diam. .75

Hab.—Kinidun, Ceylon.

Diplommatina (Nicida) delectabilis, n. sp.

Pl. ii, fig. 41.

Shell dextral, sub-ovate, pale horn colour; whorls 7, very finely spirally striate, the antepenultimate whorl much inflated, the body-whorl ascending gradually so as to finally cover the penultimate whorl just behind the peristome; suture impressed; umbilicus narrow; peristome continuous, thick, reflexed, reddish-brown, very irregular and projecting above at the point where it overlaps the penultimate whorl; aperture subcircular; columella straight.

Alt. 2 millim.; diam. maj. 1.25. Aperture, alt. .5 millim.

Hab.—Kinidun, Ceylon.

EXPLANATION OF PLATES I and II.

Plate I.

Figs. 1—1a *Tornatina tenuistriata*, n. sp.
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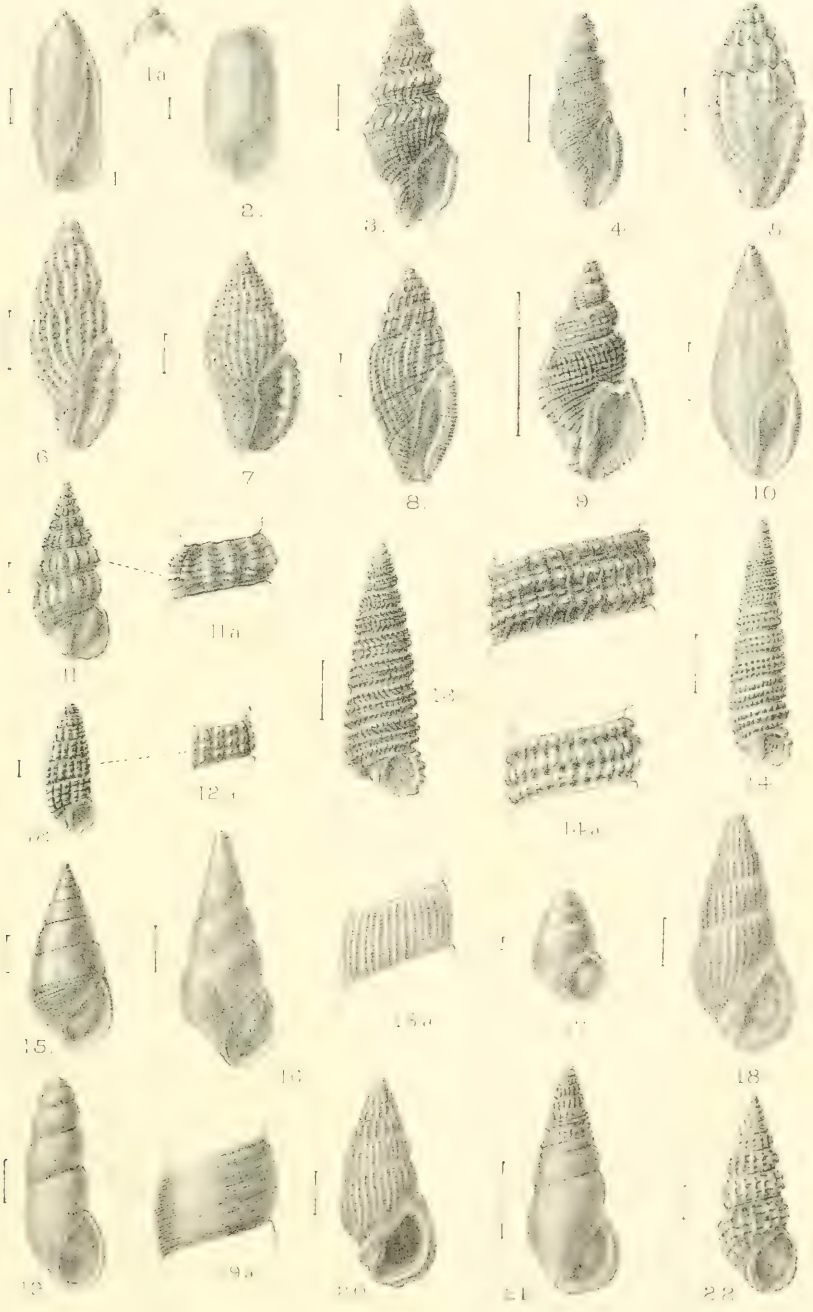
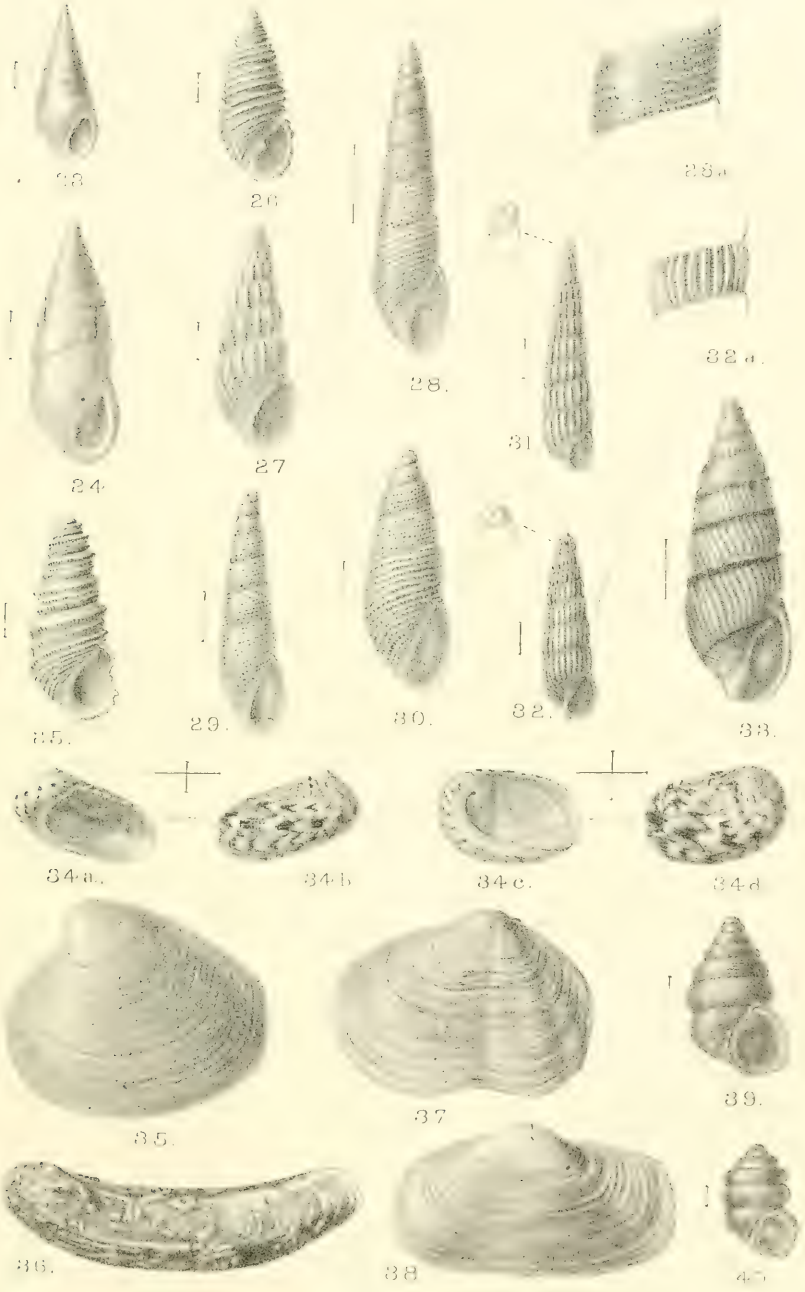


A. H. Searle, del et lith. S. Huth, imp

NEW MARINE SHELLS FROM CEYLON.



A.H.Searle, del. et lith. A.&.Huth, imp.

NEW MARINE SHELLS FROM CEYLON.

DESCRIPTION OF NINE NEW SPECIES OF HELICOID LAND SHELLS.

By G. K. GUDE, F.Z.S.

(Plates iii & iv.)

When the first portion of Dr. J. C. Cox's collection of Shells came under the hammer last year, Mr. E. R. Sykes acquired *inter alia* about 50 boxes of small Helicoids (mostly from Polynesia) which he kindly entrusted to me for examination. The majority pertain to known species, but six appear to be undescribed, and another undescribed species was found, with a number of *Baldistes bednalli*, acquired by myself from the same source.

I avail myself of the opportunity afforded by the publication of descriptions of these new species to describe also (1) a *Chloritis* from Aru, of which a single specimen was recently sent to me by Miss Linter for identification, and which differs from any species as yet known; and (2) a new *Plectotropis* from Java received from Mr. Gerrard. Moreover, two species of *Cathaica* described by me in this Journal (vol. xi, p. 93) are likewise figured. When describing these species I unfortunately overlooked the fact that one of them (*C. sturanyi*) had already been published by Dr. Kobelt in Rossmaessler Iconographie, New Series (1893), VI. p.75, pl. 169, fig. 1086.

Sitala pudica, n. sp.

Pl. iii, figs. 3a—3b.

Shell perforate, conoid, smooth, a little shining, pellucid, thin, corneous; spire convex, suture impressed, apex obtuse; whorls 4, a little convex, increasing slowly; last whorl not descending in front, angulated at the periphery, tumid below. Aperture scarcely oblique, roundly lunate; peristome thin, straight, acute; margins distant, columellar margin slightly dilated and overhanging the narrow perforation of the umbilicus.

Diam. 2 millim.; alt. 1.5.

Hab.—Cape Byron, Byron Bay, New South Wales.

Type in Mr. Sykes' collection.

Allied to *Sitala sublimis*, Hedley, which, however is more rounded at the periphery. It also resembles *S. starkei*, Brug., but that species is more sculptured above. Several shells were found to contain a number of young.

Thalassia cookensis, n. sp.

Pl. iii, figs. 4a—4b.

Shell umbilicated, conoid, finely striated, smoother and shining below, pellucid, pale corneous, spire depressed, suture margined, apex obtuse. Whorls 5, convex, increasing slowly, last whorl not descending in front, slightly flattened below, rounded at the periphery. Aperture oblique, semilunate; peristome thin, straight, acute; margins approaching, upper and outer arcuate, columellar ascending, slightly dilated over the moderate umbilicus.

Diam. 4.5 millim.; alt. 2.5.

Hab.—Aitutake, Cooks Islands. (Garrett).

Type in Mr. Sykes' collection.

Thalassia cyrtochila, n. sp.

Pl. iii, figs. 2a—2b.

Shell umbilicate, depressed, conoid, very finely arcuately striated, densely covered by excessively minute spiral lines, giving the shell a silky lustre, a little more shining below, amber coloured. Spire depressed, suture margined, apex obtuse. Whorls 4—4½, a little convex, increasing slowly and regularly at first, the last rather suddenly, and dilated at the mouth, not descending in front, rounded at the periphery, convex below, swelling towards the mouth. Aperture a little oblique, roundly lunate, margins approaching; peristome thin, straight, acute, columellar margin arcuate, dilated, slightly overhanging the moderate umbilicus.

Diam maj. 9 millim., min. 7.5; alt. 5.5.

Hab.—Long Reef, South Australia.

With *Badistes bednalli*. Type in my collection.

Allied to *Thalassia villaris*, Pfr., but more elevated, more rounded at the periphery and more swollen at the base.

Trochonanina sykesi, n. sp.

Pl. iv, figs. 7a—7b.

Shell imperforate, finely striated, smooth, shining, pale, more or less radiately streaked transversely and covered above with crowded spiral opaque creamy lines which become sparser and darker below. Spire convex, suture linear becoming crenulate at the last whorl, apex obtuse. Whorls 5, flattened, increasing slowly and regularly, last whorl not descending in front, bluntly keeled at the periphery, convex below, excavated at the umbilical region. Aperture a little oblique, securiform; margins distant; peristome thin straight acute, columellar almost vertical, thickened, slightly dilated, white.

Diam. maj. 8.5 millim., minor 8; alt. 6.

Hab.—Marquesas. (Garrett 1879).

Type in Mr. Sykes' collection.

Allied to *T. subrutila*, Pfr., and *chamissoi*, Pfr., but more elevated in the spire than either The keeled periphery and the vertical columellar margin further separate it from *T. chamissoi*.

Charopa lifuana, n. sp.

Pl. iv, figs. 6a—6c.

Shell umbilicated, discoid, finely ribbed, fuscous, opaque, solid, spire flattened, suture rather deep. Whorls 5, increasing slowly, convex above, rounded at the periphery, tumid below, obtusely angulated round the wide umbilicus. Aperture scarcely oblique, subrotundate, margins approaching; peristome straight, acute, sinuous; upper margin arcuate, columellar receding over the umbilicus, not dilated.

Diam. 3.5 millim.; alt. 1.5.

Hab.—Lifu, Loyalty group.

Type in M. Sykes' collection.

Allied to *C. vetula*, Gass., but it possesses a wider umbilicus.

Charopa ochracea, n. sp.

Pl. iv, figs. 8a—8c.

Shell umbilicated, lenticular, finely ribbed, pale ochreous, opaque, rather thin. Whorls $4\frac{1}{2}$, convex above, subangulated at the periphery, rounded below, spire flattened, suture channelled. Aperture a little oblique, subauriculate, margins approaching; peristome straight, acute; upper margin a little inflected, columellar arcuate, slightly dilated; umbilicus perspective.

Diam. 2.5 millim.; alt, 8.

Hab.—Artillery Point, New Caledonia.

Type in Mr. Sykes' collection.

Endodonta (Thaumatodon) quadridens, n. sp.

Pl. iv, figs. 9a—9d.

Shell umbilicate, lenticular, fulvous corneous, finely striated, thin, translucent. Spire depressed, suture deep, apex obtuse. Whorls 4, convex, rounded at the periphery, last whorl not descending in front. Aperture scarcely oblique, semilunate, margins convergent, united by a thin callus; peristome scarcely thickened, columellar margin slightly dilated. Within the aperture occur on the parietal wall two slender entering lamellae, at first parallel, but becoming anteriorly elevated and divergent; on the parietal wall near the peristome four denticles: two on the outer margin, the first thin and conical, the second flattened semicircular, parallel with the peristome; one on the basal margin, thin, conical; one on the columellar margin, flattened semicircular and also parallel with the peristome. Umbilicus moderate, showing three-quarters of the penultimate whorl.

Diam. 1.5. millim.; alt 0.5.

Hab.—Artillery Point, New Caledonia.

Type in Mr. Sykes' collection.

The nearest ally is *E. derbesiana*, Crosse, but that species has one broad tooth on the columellar margin and four conical denticles on the basal and outer margins.

Chloritis linterae, n. sp.

Pl. iii, figs. 5a—5d.

Shell widely umbilicate, dark rufous above, lighter below. Spire plain, apex sunken, suture channelled. Whorls $4\frac{3}{4}$, the first $2\frac{3}{4}$ increasing slowly, the last widening rather suddenly and slightly dilated at the mouth, obscurely angulated above, tumid below, obscurely angulated round the latter half of the wide umbilicus, which is steeply sloping near the mouth; finely striated under a deciduous cuticle, densely covered with short stiff bristles, arranged in quincunx. Last whorl deeply descending in front. Aperture semiquadrate; peristome thickened and reflexed, margins slightly convergent and united by a thin callus; upper margin angularly curved, fuscous, ascending shortly at first, then descending, outer margin also fuscous, rounded; columellar whitish, straight, dilated and slightly overhanging the umbilicus.

Diam. maj. 30 millim.; min. 24; alt 19.

Hab.—Aru.

Type in Miss Linter's collection.

This new species is allied to *C. dinoleomorpha*, Tapp., but it is higher in the axis, the aperture is less dilated transversely, the last whorl descends more deeply, and the umbilicus is considerably wider. The absence of spiral grooves, and the angulated sutural channel further distinguishes it from that species. The rows of bristles are also placed at a different angle. Figures 5a—5c exhibit the shell in three different positions, while figure 5d shows the periostracum enlarged.

Plectotropis leucochila, n. sp.

Pl. iii, figs. 1a—1c.

Shell umbilicated, depressed conoid, rather thin, dull corneous, becoming whitish near the mouth and below; finely striated and decussated with crowded wavy spiral striae under a deciduous cuticle, which is densely covered with transverse rows of elongated raised scales. Spire conoid, suture impressed, apex obtuse. Whorls $5\frac{1}{4}-5\frac{3}{4}$, convex above, tumid below; the last a little dilated towards the mouth and shortly descending in front, obtusely angulated at the periphery and round the widely perspective umbilicus. Aperture subcircular, oblique, margins convergent; peristome white, polished, thickened and reflected; columellar margin dilated, slightly overhanging the umbilicus.

Diam. maj. 16 millim., minor 13.5; alt. 8.5.

Hab.—Java.

Type in my collection.

In shape the present species resembles *P. sumatrana*, Mart., but that shell is much smaller, has an acutely keeled periphery and exceedingly minute scales. From *P. rotatoria*, Busch., it differs by the more depressed spire, more rounded periphery, more reflected peristome and by the umbilicus being more widened near the mouth, showing more of the penultimate whorl. A second specimen is darker than the type and measures: diam. maj. 17.5, min. 15; alt. 9.5 millim.

EXPLANATION OF PLATES III & IV.

Plate iii.

Figs. 1a, 1c. *Plectotropis leucochila*, n. sp

Figs. 2a, 2b. *Thalassia cyrtochila*, n. sp.

Figs. 3a, 3b. *Sitala pudica*, n sp.

Figs. 4a, 4b. *Thalassia cookensis*, n. sp.

Figs. 5a—5d. *Chloritis linterae*, n. sp.

Plate iv.

Figs. 6a—6c. *Charopa lifuana*, n. sp.

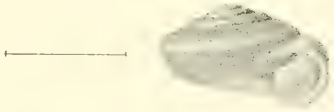
Figs. 7a, 7b. *Trochomanina sykesi*, n. sp.

Figs. 8a—8c. *Charopa ochracea*, n sp.

Figs. 9a—9d. *Endodonta (Thaumatodon) quadridens*, n. sp.

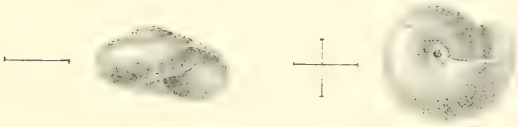
Figs. 10a—10c *Cathaica hermanni*, (Mlldff.), Gude.

Figs. 11a—11c *Cathaica sturanyana* (Rolle), Kob.

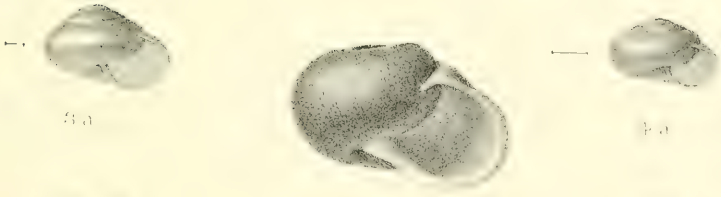


1 a

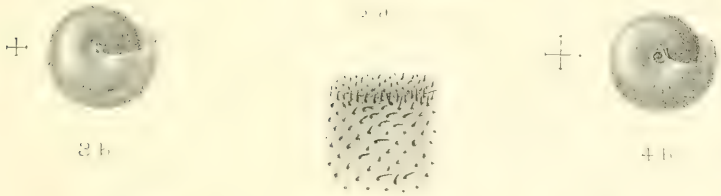
1 b 1 c



2 a 2 b

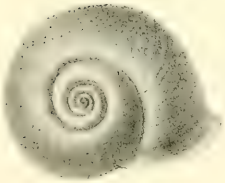


3 a 3 c 3 d

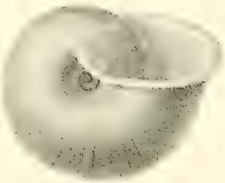


3 b 4 b

3



5 b.



5 c.

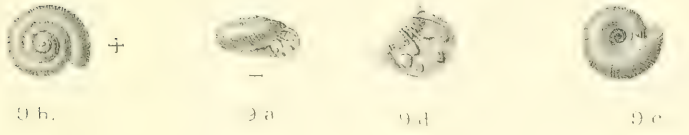
A. H. Searle, del. et lith. A.S.Huth imp.

HELICOID LAND SHELLS

6 b 6 a 6 c

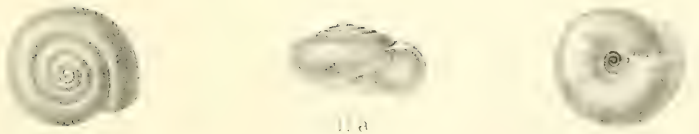
7 a. 7 b.

8 b. 8 a 8 c.



9 b. 9 a 9 d 9 c

10 b. 10 a. 10 c.



11 b 11 a 11 c

A. H. Searle, del et lith.

HELICOID LAND SHELLS.

NOTE ON A VARIETY OF PALUDESTRINA JENKINSI, E. A. SMITH.

By H. OVERTON,

Sutton Coldfield.

The shell here figured was collected by me some short time ago with other specimens of *P. jenkinsi*, E. A. Smith, many of which of were the keeled form, from the canal at Muckley Corner, near Wall, Staffordshire.

As will be seen from the figures there are a number of minute spikes irregularly distributed around the keel of the different whorls. In size and practically in all the other characters the shell is typical.

If no such variety has hitherto been described I would suggest the name *aculeata*, var. nov.

I am more interested, however, in learning something as to the probable cause which gave rise to this very striking peculiarity, and should esteem the opinion of other Malacologists who are interested in the members of this genus.

Paludestrina jenkinsi, E. A. Smith.

NOTES.

Names of Ammonites.—Several preoccupied generic names have lately been proposed for ammonites, as follows :—

(1.) *Platytes*, Mojsisovics, Abh. Geol. Reichsanst., vi, Abth. 1, p. 332, not of Gueneé, 1845 ; this may be called *Protoplatytes*, type *P. neglectus (Platytes neglectus*, Mojs.).

(2.) *Canavaria*, Buckman, Emend. Ammonite Nomencl., 1902, not of Oppenheim, 1899 ; this has been changed by Cossmann to *Canavariceras*.

(3.) *Walkeria*, Buckman, *t.c.*, not of Desvoidy, 1863, etc.

(4.) *Braunsia*, Buckman, *t.c.*, not of Kriechbaumer, 1894.

(5.) *Deltoceras*, Buckman, *t.c.*, not of Hyatt, 1894.

T. D. A. Cockerell.

CURRENT LITERATURE.

Pilsbry, H. A.—Manual of Conchology, ser. ii, vol. xvii (pt. 66), pp. 65—112, pls. 11—23. Philadelphia : Academy of Natural Sciences.

Continuing the account of the genus *Achatina*, Lamarck, the sub-genus *Leptocala*, Ancey, is dealt with, also the genera *Cochlitoma*, Fér., Pilsbry, and *Archachatina* (Alb.), Pilsbry.

Fleure, H. J.—On the Evolution of Topographical Relations among the Docoglossa. Trans. Linn. Soc. Lond., 1904, vol. ix, pp. 269—290, pls. 15—17.

The affinities of the Docoglossa are difficult to trace on account of the antiquity of the group. Dr. Fleure, however, after a valuable study of the group, comes to the conclusion that we are only justified in hinting that they and the *Bellerophontacea* are two of the earliest off-shoots from the Gastropod stem.

In this paper the common ancestor of the Prosobranch Gastropods ; the foot and edge of shell, visceral hump, branchial cavity and heart, and consolidation of the visceral mass in the Docoglossa are discussed, and a valuable summary of Docoglossan evolution and affinities given.

Fleure, H. J.—Zur Anatomie und Phylogenie von *Haliotis*. Jena. Zeitschr., 1904, Bd. xxxix, pp. 245—322, Tfn. ix—xiv.

Simroth, H.—Ueber die von Herrn Dr. Mrázek in Montenegro gessammelten Nacktschnecken unter Hinzunahme verwandten Materials. Sitzber. Gesell. naturwiss. Prag, 1904, No. 26, pp. 1—25, 1 Tf.

The new species, are : *Limax corcyrensis*, *L. mrazeki*, and *Agriolimax attemsi*.

Murdoch, R.—On the Anatomy of *Paryphanta fumosa*, Tenison-Woods. Trans. N. Z. Inst., 1904, vol. xxxvi, pp. 156—191, pl. vi.

The specimen upon which the author worked was collected at Mount Farrell, north-west Tasmania, and is one of the rarest members of the genus. Its general anatomy does not appear to present any important differences, except in the form of attachment of the buccal-mass retractor.

Nierstrasz, H. F.—Die Chitonen der Siboga-Expedition. Siboga-Expeditie, Monog. xlviii, 1905, pp. 1—114, Tfn. i—viii.

Dr. Nierstrasz in describing the Chitons of this Expedition has confined himself to the systematic side, and a description of the morphology of the shell. That the work is well done the author's name is a sufficient guarantee.

The new genera, species, etc., are :

Lepidopleurus giganteus.
Lepidopleurus simplex.
Lepidopleurus rissoi.
Lepidopleurus lineatus.
Lepidopleurus planus.
L. (*Pilsbryella*, n. sect.) *setiger.*
Ischnochiton variegatus.
Callochiton sulcatus.
Callistochiton carpenteri.
Craspedochiton tesselatus.
Squamophora oviformis, gen. et sp. nov.
Leptoplax varius.
Acanthochites biformis.
Acanthochites intermedius.
A. (*Notoplax*) *rubromaculatus.*
A. (*Notoplax*) *unicus.*
A. (*Loboplax*) *holosericeus.*
A. (*Cryptoconchus*) *burrowi.*
Chiton speciosus.
Chiton imbricatus.
Chiton reticulatus.
Tonicia sowerbyi.
Tonicia variegata.
Tonicia reticulata.
Tonicia tydemani.
Squamopleura imitator, gen. et sp. nov.

Suter, Henry.—New Land-Shells from New Zealand. Proc. Malac. Soc. Lond., 1904, vol. vi, pp. 155—157, figs. 1—6,

The new species are *Rhytida duplicata*, and *Endodonta* (*Charopa*) *transcuna*. A sinistral specimen of *Laoma moellendorffi* is also recorded, and a new sub-species (*lepida*) of *Realia turriculata*, Pfr.

Dautzenberg, Ph.— Observation sur le genra *Vaucheria*, Pallary. Bull. Soc. Zool. France, 1904, t. xxix, p. 211.

According to M. Bavay the shell for which M. Pallary constituted the new genus *Vaucheria*, is only a calcareous plate, the tergum, of the Cirripede *Pollicipes cornucopia*, Leach.

Jensen, Ad. S.—Studier over nordiske Mollusker. iii. Tellina (Macoma). N.E. Vidensk. Meddel. Kbhvn., 1905, pp. 21—52, T. 1.

Jensen, Ad. S.—*Pecten frigidus*, nomen Pecteni profundorum maris polaris incolae novum datum. Ibid., 1904, pp. 305—311, 2 figs.

Wilson, E. B.—Experimental Studies in Germinal Localization. ii. Experiments the Cleavage-Mosaic in *Patella* and *Dentalium*. Journ. exper. Zool., 1904, vol. i, pp. 197—261, 118 figs.

Glaser, O. C.—Excretory Activities in the Nuclei of Gastropod Embryos. Amer. Nat., 1904, vol. 38, pp. 513—519, 2 figs.

Baker, F. C.—Spire Variation in *Pyramidula alternata*. Ibid., pp. 661—668, 4 figs.

Jensen, C. A. & Sell, C.—Beiträge der Molluskenfauna Dänemarks. Nachr. Deutsch. Malak. Gesell., 1904, pp. 117—123.

Casteel, D. B.—The Cell-Lineage and Early Larval Development of *Fiona marina*, a nudibranch Mollusk. Proc. Ac. Nat. Sci. Philad., 1904, vol. lvi, pp. 325—405, pls. xxi—xxxv.

Gulick, A.—The Fossil Land Shells of Bermuda. Ibid., pp. 406—425, pl. xxxvi.

Pilsbry, H. A. & Vanatta, E. G.—On certain Rhachiglossate Gastropoda eliminated from the *Aquillidae*. Ibid., pp. 591—595, figs. 1—5.

Pilsbry, H. A.—New Japanese Marine Mollusca : Pelecypoda. Ibid., pp. 550—561, pls. xxxix—xli.

Dautzenberg, Ph. et Bavay, A.—Description d'un *Amussium* nouveau dragué par le Siboga dans la mer de Celebes. Journ. de Conchyl., 1904, vol. lii, pp, 207—211, fig.

Dautzenberg, Ph.—Variations et cas teratologiques chez le *Murex brandaris*, Linné. Ibid., pp. 285—287, pl. viii.

Cockerell, T. D. A.—Note on the Nomenclature of the Snails usually called *Pupa*. Naut., 1905, vol. xviii, pp. 103, 104.

Pilsbry, H. A.—Notes on the Nomenclature of *Pupillidae*, Ibid., pp. 105—107.

Pilsbry, Henry A.—New *Clausiliidae* of the Japanese Empire.—x. Proc. Ac. Nat. Sci. Philad., 1904, pp. 809—838, pls. lii—lvii.

In this, the tenth article upon Japanese *Clausiliidae* Dr. Pilsbry describes a series of specialised forms from the Ryukyu Islands and Satsuma and its islands. As a whole they are more specialised than those of either China or Japan, and bear out the proposition the author has elsewhere advanced, that insular faunas age more rapidly than those of larger or continental areas.

There are six new sections described, twenty-four new species, nine sub-species, and one variety.

EDITOR'S NOTES.

During the year 1905 the science of Malacology has been robbed of two distinguished students in the persons of Dr. Eduard von Martens, of Berlin, and D. F. Heynemann, of Frankfort on Main. Scarcely had the New Year entered than we received the sad news of the death of Professor G. B. Howes, a past President of the London Malacological Society.

There are few zoologists who have not at some time or other sought Professor Howes' aid or advice, and his removal will leave a blank which will not easily be filled.

THE

JOURNAL OF MALACOLOGY.

No. 2. JUNE 29TH, 1905. VOL. XII.

DESCRIPTION OF A NEW FLAMMULINA FROM NEW ZEALAND.

BY HENRY SUTER.

(Plate v.)

Flammulina (Thalassohelix) laingi, n. sp.

Pl. v, figs. 1—8.

Shell (figs. 1—3) globosely depressed, semitransparent, smooth, imperforate, with very fine close set lines of growth, which are crossed by numerous microscopic spiral lirae, more distinctly visible on the base. The colour is rufous-horny, whitish round the umbilical region. The epidermis is thin, slightly shining. Spire but little elevated, conoidal; the pullus consists of $1\frac{1}{2}$ obtuse whorls, which are very faintly radiately striate, and show indistinct microscopic spiral lines. Whorls 4, the last rapidly increasing, they are flatly convex, broadly rounded at the periphery and slightly impressed in the centre of the base. Suture impressed. Aperture oblique, broadly lunately oval. Peristome simple, straight, outer lip rounded, basal margin and inner lip slightly arched, the latter is strongly callous above and reflexed over the umbilical region, a broad thin callus unites the converging margins. There is no umbilicus, not even in the young stage.

Diam. maj. 14, min. 11.5; height 9 millim.

Hab.—One adult specimen, containing the animal, and a young empty shell were found on Longwood Range near Otautau, Southland, New Zealand, and kindly presented to me by Mr. Rob. M. Laing, M.A., B.Sc., of Christchurch, and I have much pleasure in uniting his name with the species.

Type in my collection.

This very handsome shell is most nearly allied to our *Flammulina (s. str.) compressivoluta*, Reeve, and also to *F. (Thalassohelix) fordei*, Brazier, from Tasmania, both of which, however, are about one-third smaller. It is

the only imperforate species of the sub-genus *Thalassohelix* I know. The animal is of a yellowish brown colour, with a black band and spots on the mantle, distinctly visible through the shell on its periphery. The caudal pore (Fig. 4) is very distinct in this species, and is surrounded by a number of roundish papillae. The jaw (Fig. 5) is arcuate, thin and fragile, composed of exceedingly fine vertical lamellae. The radula (Fig. 6) is tongue-shaped, composed of many, about 100, transverse rows of teeth which have the formula 28—7—1—7—28. The rhachidian tooth has a mesocone extending a little beyond the base, and two minute ectocones. The lateral teeth are very similar to the rhachidian; the transition teeth show the entocone and mesocone fused together into one, a small ectocone being left. The marginals have apparently only the mesocone left, and there is on most teeth a minute ectocone present, which sometimes is split up into two. This dentition is that characteristic of the sub-genus *Thalassohelix*, in which, however, the ectocones of the rhachidian tooth are mostly obsolete and the marginals with a mesocone only.

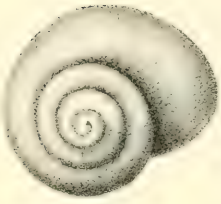
The digestive and reproductive organs (Figs. 7—8) are those we usually find in *Flammulina*, *Endodonta* and *Laoma*. The salivary glands are fused together and the stomach is rather large. The vas deferens enters the distal end of the penis sac exactly at the place where the retractor muscle is affixed; the penis is covered with rugosities of irregular shape.

Reference Letters.

b.c.	Buccal mass.	*r.s.*	Receptaculum seminis.
di. gl.	Digestive gland.	*s.d.*	Salivary duct.
int.	Intestine.	*s. gl.*	Salivary gland.
p.	Penis.	*st.*	Stomach.
r.	Rectum.	*v.d.*	Vas deferens.
r.m.	Retractor muscle.		

EXPLANATION OF PLATE V.

Figs. 1, 3, Shell of *Flammulina laingi*, n. sp.
Fig. 4. Caudal pore, magnified.
Fig. 5. Jaw, greatly magnified.
Fig. 6. Teeth of Radula, x 240.
Fig. 7. Digestive organs, magnified.
Fig. 8. Reproductive organs (part only), magnified.



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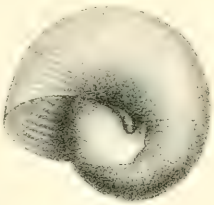
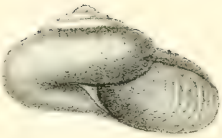


2.



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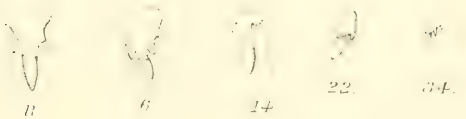

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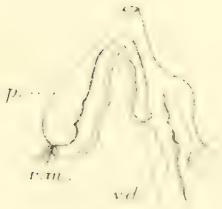


8.

H.S., del. ad nat. Huth, Lith. London

FLAMMULINA (THALOSSOHELIX) LAINGI, N. SP.

ON CHLORITIS (AUSTROCHLORITIS) PELODES, PFR., AND PSEUDOPRUNUM, PILS.

By HUGH C. FULTON.

In Vol. viii, p. 271, pl. 55. figs. 13—15. of the "Manual of Conchology," Dr. Pilsbry describes and gives the name of *pseudoprunum* to the form identified by authors as *prunum*, Fér., which form is, no doubt, as Pilsbry suggests, a species of *Badistes*. After the description Pilsbry adds a note:—"This form might be referred to *H. pelodes* Pfr., were it not for the fact that the colour and measurements given by Pfeiffer do not correspond with it."

Having examined the type specimen of *H. pelodes* in the British Museum, I have no hesitation in saying that it is the same form as *pseudoprunum*, Pils.

With regard to the measurements, the species varies, some specimens being more globular than others, and as to colour, I can quite understand some describing the shell as reddish-brown, (Pfeiffer puts it "rubello-fusca") or as light-brown, as Pilsbry puts it, others might term it a dirty-white colour.

ON DRYMAEUS EURYOSTOMUS, PHIL., AND HAMADRYAS, PHIL.

By HUGH C. FULTON.

The British Museum has recently acquired a fine series of specimens from Chanchamayo, Peru, which show that the above species are one and the same.

D. euryostomus differs only in coloration from *hamadryas*, the former being of a uniform creamy-white colour, whilst *hamadryas* has the same ground colour, but is ornamented with irregular brown stripes. Judging from the series in the British Museum, this species varies greatly in coloration, much in the same way as *membielinus*, Cr., and *cognata*, Pils. Mr. Edgar A. Smith, I.S.O., and Mr. S. I. Da Costa also agree as to the identity of the two forms in question. Both were described in the Malak. Blatt., 1867, xiv. p. 68., but the name *euryostomus* appears first on the page.

DESCRIPTIONS OF NEW SPECIES OF PAPUINA, PLANISPIRA (CRISTIGIBBA), STROPHOCHEILUS (BORUS), AND DRYMAEUS.

By HUGH C. FULTON.

(Plate vi.)

Papuina lilium, n. sp.

Pl. vi, fig. 4.

= *xanthochila* var. Cox: P.Z.S., 1873, p. 567, pl. 48, fig. 7; Tryon's Man. of Conch., vol. vii, p. 15, pl. 9, fig. 69.

This shell, although it bears a general resemblance to *xanthochila*, Pfr., is quite distinct. It differs from that species in the following respects:—it has one whorl less ($5\frac{1}{2}$), the whole shell is broader in proportion to its height, the peristome is pure white, much more widely expanded, and is strongly scored or crenulated behind.

Maj. diam. 31, alt. 42 millim.

Hab.—Solomon Islands. (ex coll. Dr. J. C. Cox).

Papuina (Dendrotrochus) pumila, n. sp.

Pl. vi, fig. 5

Shell trochiform, imperforate, rather thin, covered with a slight yellowish-green epidermis, white beneath suture thread-margined; whorls 5, convex, the last acutely carinated at the periphery, swollen and then constricted just before its termination, not descending; aperture sub-ovate, glassy-white within; peristome very oblique, thin and scarcely expanded at right margin, but somewhat thickened and expanded at the basal portion, slightly decreasing in width towards point of insertion.

Maj. diam. 13, alt. 9 millim.

Hab.—New Ireland.

In its general character, especially in having the constriction at rear of aperture, similar to *pyxis*, Hinds, but quite distinct by its different form (*pyxis* being almost as high as it is broad), its larger size and non-descending last whorl.

Papuina suprapicta, n. sp.

Pl. vi, fig. 7.

Shell moderately solid, imperforate, broadly trochoid, whitish above, the upper surface of last whorl greenish-yellow, irregularly covered with a mottled dark-brown somewhat deciduous periostracum, the under-side being of a greenish-yellow colour sharply separated at the periphery by a narrow white band which is continued above at the suture of the last whorl, rather sharply carinated at periphery of body whorl ; whorls $5\frac{1}{2}$, moderately convex, regularly increasing, smooth except for the somewhat conspicuous lines of growth, on the under-side of the last whorl there are traces of impressed spiral lines ; aperture very oblique, white within ; peristome rather broadly expanded and slightly reflected, leaden whitish colour, descending somewhat at its termination.

Maj. diam. 26, alt. 18 millim.

Hab.—New Mecklenburg (New Ireland).

Comes next to *humilis*, Fult., but is of a flatter form, further, the more oblique aperture, carinate last whorl, and different coloration above separate it from that species.

Planispira (Cristigibba) tectorium, n. sp.

Pl. vi, fig. 3.

Shell discoidal, moderately depressed, umbilicus about 2 millim. wide, subtransparent white with a narrow, pale yellowish brown band encircling the last whorl just above the periphery and continued at the suture of the penultimate whorl, spire convex, almost smooth, the oblique lines of growth not very conspicuous ; whorls 5, slightly convex, last descending to the periphery ; aperture very oblique, outer band shewing through ; peristome rather thin, constricted behind the last whorl, slightly above, but deeply behind the columellar portion, right margin slightly expanded, rather broadly so at columellar portion, which has a slight tubercular swelling about the middle.

Maj. diam. 20, alt. 12 millim.

Hab.—New Guinea (coll. Dr J. C. Cox).

By its coloration and non-planate spire, this species differs from any other of the group known to me.

Strophocheilus (Borus) rugosus, n.n.

= *santacruzi*, Pfr. : Monog. Hel,, Vol. ii, p, 23., Novit. Conch., vol. iii, p. 416, pl. 95, figs. 1, 2.

= *santacruzi*, Pilsbry : Tryon's Manual, vol. x, p. 17, pl. 4, fig. 3.

Strophocheilus santacruzi, Orbigny, of which I have seen type in the Orbigny collection, and also a co-type from the Morelet collection (ex Paris Museum), is quite distinct from the specimens identified as that species by Pfeiffer and Pilsbry.

S. santacruzi, Orb., described in the "Mag. de Zool," 1835. Moll., p. 15, and figured in the "Voyage dans L'Amerique meridionale" p. 302, t. 38, figs. 1, 2, is a much smoother shell, the two lower nepionic whorls are sculptured with fine close-set raised striae, and the post-nepionic whorls are covered with a fine spiral granulation.

The lower nepionic whorls of *rugosus* have rather distant strong radial riblets, the penultimate whorl is granulated, but the last has no granulation, but strong rugose oblique striae or lines of growth.

Comparatively speaking, *rugosus* is a rough-looking shell, while *santacruzi* is a smooth one.

Strophocheilus (Borus) versatilis, n. sp.

Pl. vi, fig. 1.

Shell almost imperforate, the opening consisting of a slight chink, oblong-ovate, solid, yellowish-brown with darker oblique stripes, spire short; whorls $5\frac{1}{2}$, moderately convex, the first two smooth, the next $1\frac{1}{2}$ having rather distant, strong, oblique riblets, the middle whorls finely granulated, the last conspicuously malleated, more especially on the last half-whorl, nepionic whorls $3\frac{1}{2}$; aperture narrowly ovate, whitish within; peristome white, thickened and rather expanded, slightly depressed at base of columellar margin, right margin suddenly thickening about half-way down, causing a somewhat tubercular-like projection; a thick white callus over the parietal wall connecting the margins of the peristome.

Alt. 98, maj. diam. 49 millim.

Hab.—(Brazil?).

This partakes of the characteristics of several known species; in form it is similar to *auritus*, Sowb., the sculpture of the middle whorls is like that of *cantagallanus*, Rang., and its nepionic and last whorls have similar sculpture to that of *bronni*, Pfr.

Strophocheilus (Borus) semimalleatus, n. sp.

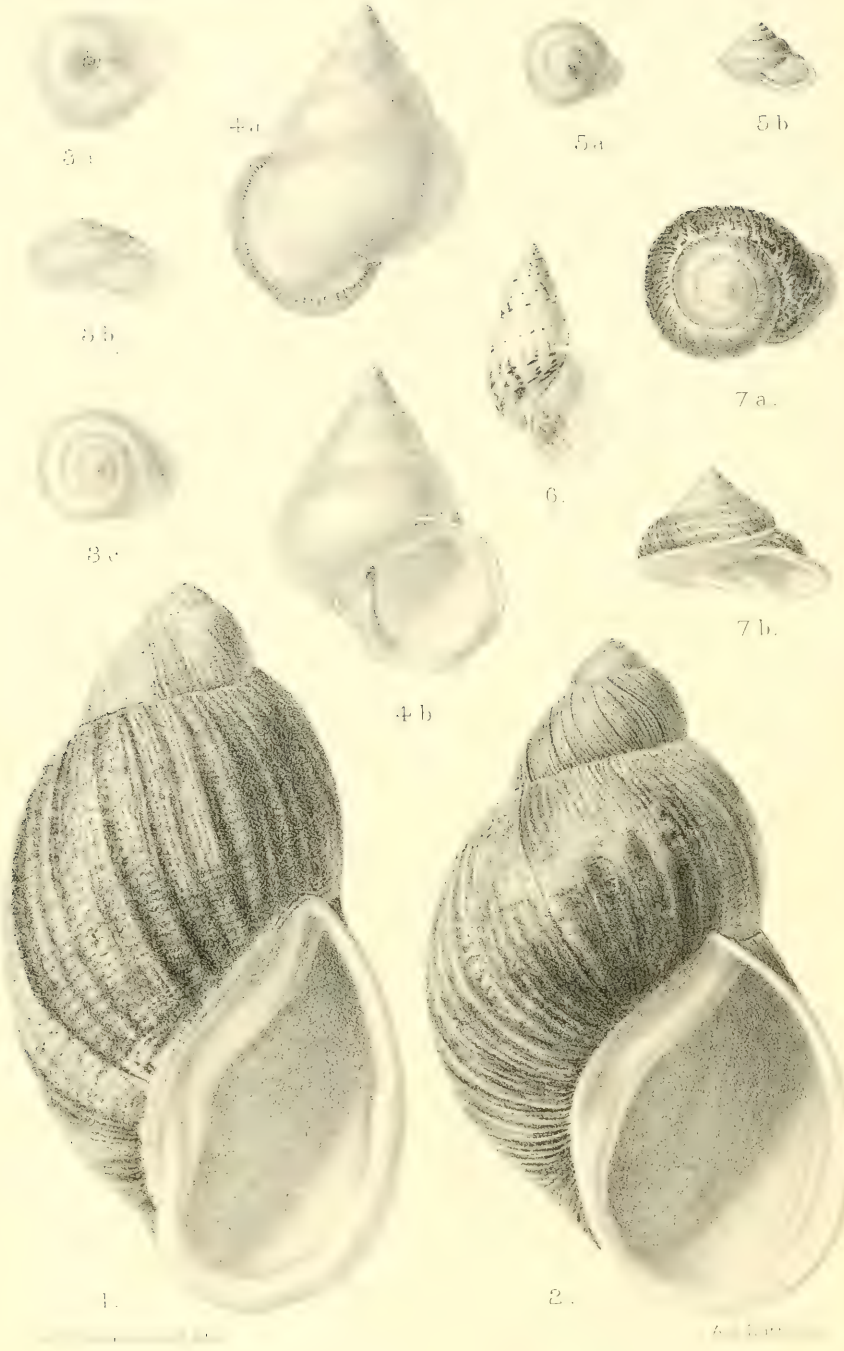
Pl. vi, fig. 2.

Shell imperforate, solid, oval, yellowish-brown cuticle below, reddish-brown above; whorls nearly 6, first one smooth, the next three with rather conspicuous close-set oblique striae, last whorl with more distant, irregular lines of growth and plainly malleated, slightly ascending at its termination; aperture oval, light-brown within; peristome thickened but expanded only at the collumellar margin, white, continued across the parietal wall by a white callus connecting the right margin.

Maj. diam. 51, alt. 90 millim.

Hab.—Peru.

Type in collection of J. J. MacAndrew, F.L.S.



NEW SPECIES OF LAND SHELLS.

Readily distinguished from *huascari*, Tschudi, to which it bears some resemblance in form and coloration, by its finely obliquely striated protoconch and by the absence of the spiral granulation found on that species.

Drymaeus regularis, n. sp.

Pl. vi, fig. 6.

Shell very narrowly umbilicate, oval acuminate, moderately solid, almost smooth, numerous microscopic, close-set spiral lines, which are (under the lens) more conspicuous on the last whorl, cream-coloured ground ornamented by a spiral series of small dark-brown spots just above the periphery, and zigzag stripes below; the nepionic whorls are horn-coloured, with the usual characteristic *Drymaeus* sculpture; whorls 6, moderately convex, last about as long as the spire, and slightly ascending at termination; aperture oval, violet within, exterior markings shewing through; peristome broadly expanded, violet, paler at margin, thin, columellar margin dilated at point of insertion.

Maj. diam. 16, alt. 31; peristome, maj. diam. 13, alt. 17 millim.

Hab.—Chanchamayo, Peru.

Near *similaris*, Moric., from which it can be readily distinguished by its broader and lilac-coloured peristome.

The colour-markings of *regularis* are smaller and more spirally arranged than in *similaris*, in which the stripes are longitudinally ziczag.

EXPLANATION OF PLATE VI.

Fig. 1. *Strophocheilus (Borus) versatilis*, n. sp.
Fig. 2. *Strophocheilus (Borus) semimalleatus*, n. sp.
Fig. 3. *Planispira (Cristigibba) tectorium*, n. sp.
Fig. 4. *Papuina lilium*, n. sp.
Fig. 5. *Papuina (Dendrotrochus) pumila*, n. sp.
Fig. 6. *Bulimulus (Drymaeus) regularis*, n. sp.
Fig. 7. *Papuina suprapicta*, n. sp.

NOTE ON THREE SPECIES OF PELECYPODS.

By EDGAR A. SMITH, I.S.O.,

British Museum (Natural History) London.

1.—**Crassatellites ponderosus** (Gmelin).

In the Proc. Linn. Soc. N.S.W. 1904, part 1, Mr. C. Hedley, in a valuable paper on some Australian Mollusca, has questioned the propriety of calling a species of *Crassatellites*, *C. kingicola*, Lamarck, substituting the name of *ponderosus* of Gmelin.

This species was founded by the latter author on figures and a description published by Chemnitz in "Der Naturforscher," Stück xix (1783) pp. 185, 186, pl. viii, and in the "Conchylien Cabinet" (1784), vol. vii, pp. 61, 62, pl. lxix, figs. A—D, the latter figures being rough copies of those in "Der Naturforscher." I feel quite certain that the shell figured by Chemnitz is not the same as the well-known *C. kingicola*, Lamarck. In the first place the form is different, being shorter and squarer, and the posterior end is both less narrowed and prolonged. Then again, in *kingicola* the posterior adductor scar is invariably of a very dark brown colour which is not mentioned by Chemnitz and is not likely to have been overlooked by him if it existed in his specimen, and still further, why should the artist draw a crenulated edge to the valves, a feature non-existent in *C. kingicola*, if it were not present in the shell before him, and why did Chemnitz write "margine subcrenulato" in his latin diagnosis, and refer, in his further description, to "den feinen Kerben ihres Randes und Umrisses"?

Mr. Hedley states that Gmelin incorrectly gives "margine crenulato" as a character, and that his error arose from the fact that Chemnitz's artist used a dotted line to represent the inner edge of the valve-margin. He also observes "the pallial line, which could hardly be 'crenulated,' is indicated by a similar dotted line." Mr. Hedley never saw the original figures in the "Naturforscher," and apparently could not have closely followed the description given by Chemnitz or he could not have made these statements. Gmelin evidently had both seen the figures and read the description, and consequently was quite justified in writing "margine crenulato." For the information of those who may not have the opportunity of seeing the work in question, I may mention that the pallial line is properly drawn in both figures of the interior of the valves and not dotted as it appears in the rough copies in the "Conchylien Cabinet."

I am of opinion that Lamarck, followed by Deshayes and others, was quite right in considersng Gmelin's species the same as the Grignon fossil, *C. tumida*, Lamarck. It agrees in form, sculpture, the enormously thick hinge and the crenulated margin.

Chemnitz's specimen was presented to him by the Messrs. Favanne de Montcervelle who were not certain of its locality, but merely state that it was given to them as having been collected on the coast of New Guinea. This I regard as altogether erroneous, and I have no doubt as to its being the fossil shell.

2.—**Arca pistachia,** Lamarck.

Mr. Hedley (l.c. supra, p. 202) regards this species the same as *A. radula* which I described in the Report upon the "Challenger" Lamellibranchiata, but I cannot admit that he is the least justified in so doing on the grounds stated by him. Lamarck's description is altogether inadequate for the determination of any species, and he neither gave nor referred to any figure. He described his shell as "ovata" and "extus grisea," characteristics which certainly are not applicable to *A. radula*. Mr. Hedley also observes,—"Lamarck's "intus fusco-nigricante; natibus proximis" are recognition-marks which distinguish the species from Australian congeners." This, however, is not true, for both *A. fasciata*, Reeve, and *A. fusca*, Bruguière have the interior more or less dark coloured, and the umbones quite as close together as they are in *A. radula*. Perhaps M. Lamy, who is studying the *Arcidæ*, may throw some light upon this subject, but at present I cannot see there are any grounds for uniting the species in question.

Mr. Lamy does not quote *A. pistachia* in his list of species preserved in the Paris Museum with Lamarck's labels, but merely refers to Deshayes's opinion that it differs little from *A. fusca*.

Timor and King Island, the localities given by Lamarck, do not assist us in the identification as they are in different seas on opposite sides of Australia.

3.—**Cardium bechei,** Reeve.

This very fine *Cardium* was originally described by Reeve (Proc. Zool. Soc., 1847, p. 25), the description subsequently being reproduced in the Zoology of the Samarang with the word "*we*" substituted for "*I*"; hence it is that Adams and Reeve have generally been regarded as the joint authors of the species. The original reference, however, has not been entirely overlooked, as stated by Mr. Hedley (l.c. p. 95), for Tryon in his catalogue of *Cardiidæ* (Amer. Journ. Conch., vol. vii, p. 268) gives it correctly although he places the authors' joint names after the species probably in deference to Reeve's wish that the species should stand under his own and Adams's name, for we cannot suppose that he was unaware of having a year previously described the species when he reproduced the original description with the slight alteration referred to.

The two very fine specimens in the British Museum mentioned by Melvill and Standen (J. Linn. Soc. Zool., vol. xxvii, p. 192) were received from the Chinese Court of the International Fisheries Exhibition of 1883. They are quite as large and in as perfect condition as the shell figured by Dunker in his Index Moll. Maris Japonici, pl. xv, figs. 1—3.

Correction.

In the April number of the Journal an unfortunate error crept into Mr. G. K. Gude's paper. On page 13, under *Charopa ochracea*, n. sp., the eighth line should read

Diam. 2.5 millim. ; alt 1.

and not alt. 8 as printed.

CURRENT LITERATURE.

Pilsbry, H. A.—Manual of Conchology, ser. ii, vol. xvii (pt. 67), pp. 113—208, pls. 24—43. Philadelphia : Academy of Natural Sciences.

The present part continues the account of the *Achatinidae*. Under *Archachatina* a new variety of *A. rhodostonia* (Phil.), v. *splendida* is described and v. *adelinae*, nov. of *A. papyracea* (Pfr.), both from West Africa. The following genera are then dealt with : *Columna*, Perry, *Callistoplepa*, Ancey, *Homorus*, Albers, under the sub-genus *Subulona*, Marts., of the last-mentioned genus *H. pallalus* is a new species from Cape Palmas, Liberia, also *H. opeas*. Then follow accounts of the genera *Ceras*, Dup. and Putz., *Pseudoglessula*, Boettg., *Chilonopsis*, F. de Waldh. (and the sub-genus *Cleostyla*, Dall), *Trichodina*, Ancey, with *T. aratispira* a new species from Liberia (?), the part concluding with accounts of *Clavator*, Marts., and *Riebeckia*, Marts., in part.

Hoyle, William E.—The Cephalopoda. From the Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii, supplement i, pp. 975—988, pl. xcv, text-figs. 144—153.

The actual number of specimens identified in this collection is thirteen, of which the prize is undoubtedly a specimen of *Ancistrochirus lesueuri*, which was found floating on the surface. One new species is described, *Polypus gardineri*.

Bloomer, H. H.—On the Anatomy of certain species of *Siliqua* and *Ensis*. Proc. Malac. Soc. Lond., 1905, vol, vi, pp. 173—196, pl. xii.

Mr. Bloomer describes the anatomy of *Siliqua patula* (Dixon), from which *S. costata* (Say) differs only in certain points in the shell. *Ensis directus* (Conrad), he finds closely resembles *E. ensis*, as does also *E. minor*, Dall.

Eliot, C. N. E.—Notes on two rare Nudibrauchs, *Hero formosa*, var. *arborescens*, and *Staurodoris maculata*. Proc. Malac. Soc. Lond., 1905, vol. vi, pp. 239—243.

From St. Andrews, N.B., the author has received specimens of a well marked variety (*arborescens*, n. var.) of *Hero formosa*, which possibly may merit specific rank. The other species, *Staurodoris maculata* (Garst.), is from Plymouth. Possibly this is von Ihering's *St. pseudoverrucosa*, from Naples, and the *Doris cubalia* of Fischer, from Arcachon, the young of this species.

Blanford, W. T.—Descriptions of Indian and Burmese Land-Shells referred to the Genera *Macrochlamys*, *Bensonia*, *Taphrospira* (gen. nov.), *Microcystina*, *Euplecta*, and *Polita*. Proc. Zool. Soc., 1904, pp. 441—447, pl. xxv.

The new species are *Bensonia nepalensis*, Nevill MS., *Taphrospira* (gen. nov.), type *T. convallata*, Bs., *T. excavata*, *Macrochlamys kuluensis*, Nevill MS., *M. superflua*, *M.* (?) *atoma*, Fairbank MS., *M. prava*, *M. rutila*, *M. chaos*, *M. notha*, *M. noxia*, *M. curvilabris*, *M. spreta*, *M. patens*, *M. pseudochoinix*, *Microcystina stuarti*, Godwin-Austen MS., *M. shevaroyana*, *Euplecta pulchella*, and *Polita* (?) *turbinata*.

Nierstrasz, H. F.—Bemerkungen ueber die Chitonensammlung im Zoologischen Museum zu Leiden. Notes from the Leyden Mus., 1905, vol. xxv, pp. 141—159, pl. 9, 10.

The author describes and figures the following new species: *Callistochiton leidensis*, and *C. porosus*, and gives notes and figures on other species.

Farran, G. P.—Report on the Opisthobranchiate Mollusca collected by Professor Herdman, at Ceylon, in 1902. From Rpt. on Pearl Oyster Fisheries of the Gulf of Manaar. Roy. Soc. Lond., 1905, pp. 329—364, pls. i—iv.

The collection comprises thirty species of Nudibranchs, of which nine are new, twelve are fairly well-known tropical species, four are identified with species described by Abraham or Quoy and Gaimard, but of which little was known, and five are too small to identify satisfactorily. The new species are: *Hervia ceylonica*, *Galvina producta*, *Linguella cinerea*, *Platydoris herdmani*, *P. (?) spinulosa*, *Halgerda punctata*, *Thordisa (?) caudata*, *Chromodoris tenuilineata*, and *Aegires villosus*.

Of the Tectibranchiata there are seventeen species, of which seven are described as new, viz., *Aplysia intermedia*, *Phyllaplysia albomaculata*, *P. pellucida*, *Aplysiella mollis*, *Dolabrifera marginata*, *Notarchus ceylonicus*, and *Pleurobranchus hornelli*.

An Appendix records *Onchidium verruculatum*, Cuv., and *Marsenia perspicua* (Linn.).

Eliot, C.—On some Nudibranchs from East Africa and Zanzibar. Part vi. Proc. Zool. Soc. Lond., 1905, pp. 268—298, pls. xvi, xvii.

The following new species are described: *Orodoris striata*, *Dolo africana*, *Hervia lineata*, *Phidiana tenuis*, *Facelina lineata*, *Stiligar varians*, *S. irregularis*, and *Elysia dubia*. Nineteen other species are recorded with notes thereon.

Eliot, C. N. E.—On some Nudibranchs from the Pacific, including a new genus, *Chromodoridella*. Proc. Malac. Soc. Lond., 1905, vol. vi, pp. 229—238.

The author states that the type of this new genus *(C. mirabilis)* "may be succinctly described as a *Chromodoris* with the branchial pocket situated, not on the dorsal surface, but on the under side of the body, and pointing downwards." The author confesses to considerable doubt as to whether it is a normal form or a monstrosity.

Sacco, F.—I Molluschi dei terreni terziarii del Piemonte e della Liguria. Torino, 1904, pp. i—xxxvi.

Lebour, M. V.—Additions to the List of the Marine Mollusca of Northumberland. Rpt. Sci. Inv. Northumberland Sea Fish. Comm., 1904, p. 85.

Ihering, H. von.—On the genus *Tomigerus*, Spix, with descriptions of new species. Proc. Malac. Soc. Lond., 1905, vol. vi, pp. 197—199, figs. 1—3.

Suter, Henry.—Notes on some New Zealand *Pleurotomidae*. Ibid., pp. 200, 201.

Suter, Henry.—Notes on some species of *Chione* from New Zealand. Ibid., pp. 202—205.

Dall, W. H.—An arrangement of the American *Cyclostomatidae*, with a revision of the nomenclature. Ibid., pp. 208—210, figs. 1, 2.

Jukes-Brown, H. J.—A Review of the genera of the family *Mytilidae*. Ibid., pp. 211—224.

Melvill, J. C. and Standen, R.—*Rostellaria delicatula*, Nevill. Note upon its distribution and limits of variation. Journ. Conch., 1905, vol. ii, pp. 161—163, pl. ii.

Melvill, J. C.—The sub-genus *Casmaria*, H. and A. Adams, of *Cassis*, Lamarck. Ibid., pp. 176—178.

Melvill, J. C.—Four Colour Varieties of *Cypraea*. Ibid., p. 192.

Vayssière, A.—Étude sur les coquilles de quelques *Cypraea*. Journ. de Conchyl., 1905, vol. liii, pp. 5—17, pl. i.

Bavay, A.—Sur quelques espèces nouvelles, mal connues ou faisant double emploi dans le genre *Pecten*. Ibid., pp. 18—30, pl. ii.

Vignal, L.—Note sur la section *Pyrazus* dans le genre *Potamides*, et description d'une espèce nouvelle. Ibid., pp 31—45, fig.

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No. 3. SEPTEMBER 29TH, 1905. VOL. XII.

NOTES ON A COLLECTION OF CALIFORNIAN NUDIBRANCHS.

BY PROFESSOR T. D. A. COCKERELL AND SIR C. ELIOT, K.C.M.G.

(Plates vii and viii.)

The animals described below were collected by Mr. Cockerell at San Pedro and La Jolla in South California (about 33° S). He also supplied the coloured sketches and accounts of the living animals which added much to the value of the present paper, and I have, therefore, coupled his name with mine as one of the authors, since it was not always possible to quote his descriptions as they generally take the form of a few words written at the sides of rough sketches. But he is not responsible for the descriptions of the preserved specimens or for any of the views expressed in the following pages. The new specific names are due to him, the generic names to me. Some of the specimens had been deposited in the British Museum, and I have to thank Mr. E. A. Smith for kindly allowing me to examine them. The collection contains the following species :—

1. *Tritonia palmeri*, Cooper.
2. *Archidoris montereyensis* juv. (Cooper).
3. *Cadlina flavomaculata*, MacFarland.
4. *C. marginata*, MacFarland.
5. *Chromodoris californiensis*, Bergh. = *Chr. universitatis*, Cockerell.
6. *Doridopsis vidua* (?), Bergh.
7. *D. reticulata*, n. sp.
8. *Acanthodoris rhodoceras*, n. sp.
9. *Laila cockerelli*, MacFarland.
10. *Triopha* sp.
11. *Aegires albopunctatus*, MacFarland.
12. *Dirona picta*, MacFarland.
13. *Janolus coeruleopictus*, n. sp.
14. *Spurilla chromosoma*, n. sp.
15. *Hermissenda opalescens* (Cooper).
16. *Phyllobranchopsis enteromorphae*, gen. et spec. nov.

The specimens are small and the majority are not well preserved. This is especially regretable in the case of the two rather remarkable new genera *Dirona* and *Phyllobranchopsis*, but the characters which can be established with certainty seem to warrant the descriptions here given. The small size of the specimens, particularly the Dorids, is noticeable. It does not appear to be charactistic of the Californian fauna for it is not supported either by Mac Farland's observations or by my own made when visiting this coast in 1899. Mr. Cockerell collected both at San Pedro and La Jolla in July and August. It seems probable that the animals spawn early in the summer so that at this period young and half-grown individuals are prevalent. The specimens of *Hermissenda* on the other hand are larger than those recorded hitherto.

The latitude of San Pedro and La Jolla is about the same as that of the Canary Islands, and as far as the nudibranchs of this part of the Atlantic are known, the character of the fauna in this group seems much the same in both Oceans. The northern element appears to be the stronger, as shown by the prevalence of forms like *Archidoris*, *Cadlina*, *Acanthodoris*, *Aldisa*, *Rostanga* and various Polycerids, while such tropical genera as *Chromodoris* and *Doridopsis* are sparingly represented. *Platydoris*, so common in the Indo-Pacific, has not yet been found in California, but *Chromodoris* appears to extend further north than in the Atlantic, being recorded from Puget Sound. Specially characteristic of this coast is the number of Polycerids, both in species and individuals, such as *Triopha* and *Laila*. Aeolids are also abundant.

Another remarkable feature of the nudibranch fauna of the Pacific coast of North America is the number of species closely resembling or even identical with those found in the northern Atlantic. Bergh considers that *Archidoris tuberculata*, *Acanthodoris pilosa*, *Lamellidoris bilamellata*, *Dendronotus arborescens* as found in these waters are not specifically distinguishable from the Atlantic forms. *Spurilla chromosoma* is nearly related to *Sp. neapolitana*, *Aeolidia herculea* to *Ae. papillosa*, *Tritonia palmeri* to *T. plebeia* and *T. lineata*, *Aegires albopunctatus* to *Ae. punctilucens*, *Adalaria pacifica* to *A. proxima*. It is noticeable also that the fauna of New Zealand and the extreme south of the Pacific as far as it is known presents many analogies to that of the northern Pacific and northern Atlantic. On the other hand, some of the commonest Californian nudibranchs belong to genera which have not been found elsewhere, such as *Triopha*, *Laila*, *Hermissenda*

The nudibranchs of this coast were first noticed by Cooper and Stearns, but the most important contributions to our knowledge of them, are contained in Bergh's Nudibranchiate Gastropoda of the North Pacific (1879), published in Dall's Scientific Results of the Exploration of Alaska, and Mac Farland's Preliminary account of the *Doridiidae* of Monterey Bay, California (Proc. Biological Society of Washington, Feb. 2nd, 1905, vol. xviii.). It is understood that the latter author is about to publish a fuller account of the

Doridídae with plates, and will also deal with the *Aeolidídae*. Even the preliminary diagnoses are models of lucidity, but I must confess that I do not at present see why a new genus is required for *Montereina*, or why *Hopkinsia* is separated from *Idalia*.

Tritonia palmeri, Cooper.

Pl. vii, figs. 1, 2.

Cooper: Proc. Calif. Acad. Nat. Sci., 1863, II. p. 207; Cockerell: Nautilus, 1902, xv. p. 117.

One small specimen from Dead Man's Island, San Pedro, found between tides. The notes on the living animal state that it was about 17 millim. long, white, but strongly suffused with yellow dorsally. The back is described as rugose with small warts. There were five or six "ramose branchial lamellae" on either side.

The alcoholic specimen is 10 millim. long, nearly 5 broad, and 4 high. It is very badly preserved and little can be made out of the external characters except that the shape is square and thick set, and that the oral veil bears about 10 digitate processes. The tail is short and broad.

The central nervous system is whitish and granulate, apparently much as in *T. Hombergi*. The eyes are large and black; the jaws are long, yellowish with 4—6 rows of very strong and distinct denticles on the edge and a mosaic pattern behind them.

The formula of the radula is 36 × about 35. 1. 1. 1. 35 as a maximum, but many of the rows are considerably shorter. The median tooth (Fig. 1*a*.) bears three very distinct thick cusps, that in the centre pointed, those at the sides rounded. The first lateral (Fig. 1*b*) has a broad base, but is distinctly hamate, the hook coming over the side of the median tooth. The remaining laterals (Fig. 2) are rather straight and not very thick. Those near the outside are longer but the outermost are shorter. No armature was discovered in the stomach.

This form appears to be clearly distinct from *T. tetraquetra*, *gigantea*, *exsulans*, and *diomedea* recorded from the Pacific coast of North America and to be allied to *T. (Candidla) plebeia* and *lineata* It is distinguished by its coloration and the larger number of processes on the velum. The dentition appears to resemble that of *T. lineata* rather than *T. plebeia*, but the teeth are not a very certain criterion in this genus.

The genus *Tritonia* is recorded chiefly from the temperate parts, northern as well as southern, of both the Atlantic and Pacific. Nearer the Equator it appears to be replaced by *Marionia*, though its absence cannot be regarded as certain. Including the sub-genus *Candiella*, it contains about 24 species, some of which are doubtful. To the sixteen enumerated in Bergh's System der Nudib. Gasteropoden, the following may be added: 17. *T. diomedea*, Bergh. 18. *T. exsulans*, Bergh. 19. *T. incerta*, Bergh. 20. *T. australis*, Bergh. 21. *T. gigantea*, Bergh. 22. *T. ingolfiana*, Bergh. 23. *T. villafranca*, Vayssière. 24. *T. appendiculata*, Eliot. *Tritonia alba*, described but not figured, by Alder & Hancock, is a somewhat doubtful form.

Archidoris montereyensis, juv. (Cooper).

Three small specimens from La Jolla may be immature individuals of this species; they are all less than a centimetre long, yellowish in colour, and indistinctly tuberculate. The tentacles are flattish and grooved, the branchiae seven and tripinnate; the radula is about 30 × 45. 0. 45; the teeth are colourless, hamate, crowded near the rhachis and bear a lateral wing-like expansion. There is no labial or genital armature.

The genus *Archidoris* is recorded chiefly from temperate seas, but is perhaps cosmopolitan in its distribution, as two species are found in equatorial East Africa. The common British *A. tuberculata* appears to be also found on the Californian coast. Bergh, in his System recognizes five species, or six if *A. marmorata* is considered distinct, and the following have since been added:—

7. *A. stellifera,* Jher.
8. *A. rubescens,* Bergh.
9. *A. incerta,* Bergh.
10. *A. nyctea,* Bergh.
11. *A. africana,* Eliot.
12. *A. violacea,* Bergh.
13. *A. minor,* Eliot.
14. *A. nanula,* Bergh.
15. *A. wellingtonensis,* (Abraham).

Bergh has created separate genera for *Anisodoris* and *Homoiodoris*, both of which resemble *Archidoris* externally, but are distinguished from it by the presence of a prostate, and from one another by the vagina having an armature in *Homoiodoris* which is absent in *Anisodoris*. If these genera are retained, I cannot see why *Montereina*, Mac F. (Mac Farland, l.c. p. 38) is separated from *Anisodoris*. It appears to have the same essential characters both internal and external, and to differ in being larger, more arched, and in bearing larger tubercles, all of which seem differences of degree hardly amounting to generic characters.

Cadlina, Bergh.

This genus, which is distinguished from most cryptobranchiate Dorids by the presence of a median tooth, is recorded only from the cold and temperate seas of the northern hemisphere. The known species are:—

1. *C. repanda* (A. & H.). N. Atlantic.
2. *C. glabra* (Friele & Hansen) N. Atlantic.
3. *C. clarae,* Jher. Med.
4. *C. pacifica,* Bergh. West Coast of N. America.
5 *C. flavomaculata,* Mac F. West Coast of N. America.
6. *C. marginata,* Mac F. West Coast of N. America.

The genus will, perhaps, prove charactsristic of the Coasts of North West America, since three species are already recorded. The animal described

below as *C. marginata* (?) is certainly a *Cadlina*, but perhaps a new species. *Tyrinna*, Bergh. from the West Coast of South America has a similar dentition.

Cadlina flavomaculata, Mac Farland.

Mac Farland: Prelim. account of *Doridiidae* of Monterey, pp. 43—4.

Two small specimens from La Jolla, one elongate (8 × 3 millim) the other almost circular and with an ample margin. Neither are well preserved and the colours have almost entirely vanished, though it can still be seen that the rhinophores were very much darker than the rest of the animal. The back is tuberculate; the oral tentacles flat; the branchiae are about 10, and apparently simply pinnate. The labial armature is yellowish and consists of close-set deeply bifid rods. The radula is narrow, the formula being about 90 × 27. 1. 27, but many rows are shorter. The central tooth is large and strong, and bears 4—5 distinct, long denticles of much the same size. The first laterals are stout, with 2—3 denticles on the inner side, and 5—6 on the outer side of the central cusp. The remaining laterals are denticulate on the outer side only, and near the rhachis bear 12—15 minute serrulations which increase in size and prominence about the middle of the row, so that the teeth of the outer-half have, as Mac Farland says, a saw-like appearance.

Cockerell says the living animal which was found in kelp roots washed up on shore was white, with 5 sulphur yellow spots on each side. The rhinophores were very conspicuous dark-reddish brown, with about six perfoliations on each side and white tips. The skin was spiculous, and the oral tentacles short and triangular.

Externally this species seems characterised by the dark rhinophores, contrasting markedly with the otherwise pale colouration, internally by the large and deeply denticulate central tooth. The simply pinnate branchiae are also noticeable.

Cadlina marginata, Mac Farland. (?)

Mac Farland: l.c., p. 43.

Three small specimens from La Jolla are probably referable to this form in virtue of their buccal parts, though none of their external characters can be traced, the animals being much contracted, smooth and of a uniform purplish-grey.

The labial armature consists of bifid hooks. The radula consists of about 80 rows, containing 40—50 teeth on each side of the rhachis. The rhachidian tooth is not conspicuous, and bears 4—5 small blunt denticles. The innermost laterals are strongly hooked with 3 denticles on the inner and 6—7 on the outer margin. The remaining laterals become longer and slenderer towards the end of the rows, and bear about 12 denticles on the outside only. The outermost teeth are rudimentary and irregularly jagged.

Chromodoris, Ald. & Hanc.

This large genus, the most numerous in species of all the *Doridídae* cryptobranchiatae, is chiefly found in warm seas, and is specially characteristic of the tropical Indo-Pacific. It occurs in the Mediterranean, and is probably found in the adjacent parts of the Atlantic, though it appears to be recorded only from the Cape Verde Islands and the Bermudas, the latter record not being very certain. In the Pacific it is recorded from as far north as Japan, and on the American Coast from Puget Sound and Monterey: in the south from New Zealand, Tasmania and Juan Fernandez.

The brilliant coloration, common in the genus, has caused a great number of species to be figured and described, often very inadequately. Burgh's list in the System includes 105 species, and about 18 have been described since. *Chr. universitatis*, Cockerell, as explained below, appears to be *Chr. californiensis*, B., and *Chr. tenuilinearis*, Farran (1905), is, I think, the same as *Chr. nigrostriata*, Eliot (1904). Bergh has shown that *Chr. elizabethina* should be called *Chr. quadricolor* (Rüppel & Leuckart), and *Chr. petechialis* (Gould) 1852, is probably identical with *Chr. tumulifera*, Collingwood and *Chr. pallescens*, Bergh. *Chr. aureo-marginata*, Cheeseman (Trans. New Zealand Institute, 1880, xiii, p. 223.) is probably identical with one of the many previously described species which have a similar coloration. The following species are more or less valid:—

106. *Chr. agassizii*, Bergh.
107. *Chr. porterae*, Cockerell.
108. *Chr. macfarlandi*, Cockerell.
109. *Chr. sykesi*, Eliot.
110. *Chr. cavae*, Eliot.
111. *Chr. annulata*, Eliot.
112 *Chr. splendens*, Eliot.
113. *Chr. vicina*, Eliot.
114. *Chr. nigrostriata*, Eliot.
= *Chr. tenuilinearis*, Farran.
115. *Chr. inconspicua*, Eliot.
116. *Chr.* (?) *flava*, Eliot. (Anatomy unknown.)
117. *Chr. tasmaniensis*, Bergh.
118. *Chr. figurata*, Bergh.
119. *Chr. aegialia*, Bergh.
120. *Chr. atopa*, Bergh.

Chr. (?) *rosco-picta*, Verrill, is an interesting form, but some doubt must remain as to its genus, since the dentition is unknown, and it bears papillae on its back which is unusual in *Chromodoris*..

The Chromodorids recorded from the North West Coast of America are *Chr. dalli*, *californiensis*, *agassizii*, *macfarlandi*, *porterae* and *aegialia* (Gulf of California.)

Chromodoris californiensis, Bergh.

= *Chr. universitatis,* Cockerell.

Bergh: Exploration of Alaska: Nudibranchiata part I, 1879, p. 112; id. Bull. of Mus. of Comp. Zool. Harvard, 1894, vol. xxv. no. 10; Cockerell: Nautilus, June 1902, p. 19.

One specimen marked by Mr. Cockerell "one of the type lot," captured at San Pedro, California, August 1901. It is unfortunately very much wrinkled and contorted, so that little trace of its former appearance remains.

Length 28.5 millim.; height 15.5; breadth 12; length of tail 11 millim. The colour is a dirty bluish-grey, which shows traces of yellow here and there, though no spots can be distinguished. The mantle has disappeared entirely at the sides, but it is ample behind, where it bears on its lower surface seven large brown globes, 2.5 millim. in diameter. They are hollow and filled with a mass of yellowish granules, which is not attached to the walls, but lies free, like the contents of a stomach. The mantle is not ample over the head, the tentacles are fairly large, partially retracted, with pits at the tips. The edge of the rhinophore pockets are raised, but not those of the branchial orifice, which is small, with a flat thickened rim. The branchiae are entirely retracted and set in a circle open behind. One plume is trifid, one quadrifid and the rest simply pinnate. The foot is grooved in front but not notched.

The internal organs and membranes are greenish, much hardened, but apparently as usual in the genus. The liver is large; the labial armature consists of two olive coloured plates, composed of mace-shaped elements, set so as to form a tessellated pattern. The radula consists of 106 rows, containing more than 100 teeth on each side of the naked rhachis. The first ten rows or so are deep brown, the rest yellowish. The teeth are bifid, with about 8 denticles on or below the lower prong. The upper prong is not denticulate. The inner teeth are smaller, lower, and bear fewer denticles. The outermost are also lower and rather irregular.

If this is the type of *Chr. universitatis*, Cockerell, there would appear to be no sufficient ground for separating that species from *Chr. californiensis*, Bergh, which is recorded from the Santa Barbara Islands, Monterey and San Diego. The buccal parts of the two agree, and both have conspicuous spherical projections on the under side of the posterior mantle. The coloration also is similar. *Chr. universitatis* is described by Cockerell as "dark rich ultramarine blue; the edge of the mantle and foot bright cobalt blue; mantle with two longitudinal series of oblong very bright orange spots, about 7 in a series; five round orange spots on the anterior part of the mantle in front of the rhinophores." Dall described the living *Chr. californiensis* as "mazarin blue with golden spots," and according to Bergh the preserved specimen was "greenish blue. On the back were several yellowish-white round spots. On the anterior part, they were chiefly in the median line, on the rest, in two longitudinal series . . . a brighter fine line seemed to border

the margin of the mantle edge, and that of the foot." The branchiae are recorded as 12 in *Chr. universitatis*, and 9—10 in *Chr. californiensis*, but this variation can hardly be regarded as specific.

Acanthodoris, Gray.

This genus, and indeed the whole family to which it belongs, (including *Akiodoris*, *Doridunculus*, *Adalaria and Lamellidoris*) has hitherto been found only in the cold or temperate seas, but penetrates into Arctic waters and probably also Antarctic, as it is recorded from far south. Only the rather doubtful *Lamellidoris* (?) *graeffii*, Bergh, is recorded from the Mediterranean. Bergh enumerates 8 species of *Acanthodoris* in his System, but of these *A. stellata*, Verrill seems to owe its existence merely to a question of nomenclature.* Since then, the following species have been added:—

8. *A. metulifera*, Bergh.
9. *A. hudsoni*, Mac Farland.
10. *A. brunnea*, Mac Farland.
11. *A.* (?) *vatheleti*, Mabille & Rochebrune.
12. *A. rhodoceras*, n. sp.

From Behrings Sea, and the Pacific Coast of North America are recorded *Ac pilosa* (typical), *Ac. pilosa* var. *albescens*, do. var. *purpurea*, *Ac. coerulescens*, *Ac. hudsoni*, *Ac. brunnea*, and *Ac. rhodoceras*. The common British *Ac. pilosa* appears to have an astonishingly wide distribution, for forms which Bergh regards as mere varieties of it are found in the North Pacific, New Zealand and Tasmania. It is remarkable, however, that in all the known southern forms, the verge is unarmed, a fact worth bearing in mind when estimating the importance of this character, which is thus admitted to vary within the limits of the same species.

Acanthodoris rhodoceras, n. sp.

Pl. vii, figs. 3, 4.

One specimen from Dead Man's Island, San Pedro, California. It is soft, flat, oval and well preserved. The notes on the living animal say that the back bore hyaline papillae and also shorter black papillae. On the dorsal margin was a narrow black band, edged below with yellow. The rhinophores were reddish with a yellow streak, the left paler, and with more yellow than the right. The length was about 15 millim. From a rough sketch it would appear that the ground colour of the back was yellowish-grey; the sole was white. The colours are still recognizable. The back is pinkish-grey, and is

* If I rightly understand Verrill (Am Journ of Sci. and Art. 1879, p. 313), he considers that his specimens = *Doris stellata*, Gemlin, = *Doris pilosa*, A. & H., but are different from *D. pilolsa*, Müller. If so the animal should be called *Ac. stellata* (Gmelin). But both Bergh and Alder & Hancock seem to regard the animal figured by the latter authors (which is Gmelin's *Doris stellata*) as identical with *Doris pilosa*, Müller. If so, *Ac. stellata* has no separate existence.

covered with black-tipped papillae, among which, especially near the margin, are some rather larger colourless papillae. The black tips of the papillae, and the black border round the mantle are very vivid and distinct. The length is 12 millim.; the breadth 10 millim., and the maximum height 5 millim. The rhinophores are retracted, and the pockets not very easy to see as they are surrounded by tubercles, some colourless, some tipped with black. The branchiae are pinkish-grey, not ample, bi—and in places tripinnate. They are five in number, but in a vacant place on the right side of the circuit are some rudimentary plumes, suggesting that the full number is six. Though there is no pocket into which the branchiae can be retracted, the branchial area is differentiated from the rest of the back. It is of a deeper pink colour, bears very few tubercles, and in parts, though not everywhere, is surrounded by a rim formed by the union of some of the dorsal papillae. This is probably the same arrangement as that described by Abraham for *Calycidoris*. The anal papilla is central. The foot (9 millim. × 6.5 millim.) is broad and rather abruptly pointed behind. The anterior margin is straight. The head is surrounded by a crescent-shaped veil about as wide as the foot, and prolonged into short horns on either side. The sides of the body, the margin of the mantle, and the branchial area contain a fair number of spicules, but there are none in the rest of the dorsal surface. They are brownish rods, bearing many marks resembling joints and divisions, bent in various ways, but not branched or thickened in the middle.

The buccal mass is pinkish; the ingluvies buccalis which is imbedded in it is divided into two halves by a white stripe. The labial cuticle bears two prominent thick folds. The labial armature is a band of mosaic consisting of squarish blocks (Fig. 3), irregularly cleft (often quadrifid) at the top. Below these clefts are a number of minute, hardly visible, prominences. The formula of the narrow radula (Fig. 4), is 27 × 5 or 6. 1. 0. 1. 5 or 6, the sixth tooth being very often absent. The rhachis is quite bare; the innermost teeth are much larger than the others, and of the shape usual in this genus. They have a large base and bear about 5 denticles (sometimes with a few smaller additional denticles) near the top of the hook. The other teeth are much smaller and are almost covered by the broad base of the first tooth; they decrease in size outwards, and are quite smooth, but preserve something of the hamate shape.

The liver is large and greenish; the greater part of it is covered with a thick white layer, formed by the hermaphrodite gland. The mucous gland is large, white and transparent. The spermatoduct is long and consists of two parts, the upper soft, and the lower muscular; this lower portion and the verge are thickly covered with small, slightly hooked, transparent prominences. The central nervous system is distinctly granulate. The pedal ganglia are set below, and at the sides of the cerebro-pleural. The eyes are on rather long stalks.

Doridopsis.

This large genus has much the same distribution as *Chromodoris*, and like it, is specially characteristic of the tropical Indo-Pacific. It is found in the Mediterranean, and is recorded from various parts of the Atlantic, extending as far north as the Bay of Biscay. In the more Northern Pacific it is recorded from Ningpo and Yokohama, on the Asiatic side, and from California, as far north as Monterey, on the American side. The only known Californian form besides those described below is *D. fulva*, MacFarland.

Bergh's list in the System includes 60 species, but *D. vidua* and *D. spiculata* are omitted from it, and no. 40 *D. lacera* (Cuv.) = *D. wellingtonensis*, Abr., should be removed, for *D. lacera* is almost certainly a *Hexabranchus*, and *D. wellingtonensis* is an *Archidoris* (see Eliot, Proc. Mal. Soc., 1905, p. 236.). Few new forms have been described of late years, and it would appear that the list can be brought up to date as follows :—

60. *D. vidua*, Bergh.
61. *D. spiculata*, Bergh.
62. *D. fulva*, MacFarland.
63. *D. punctatella*, Bergh.
64. *D. reticulata*, n. sp.

Doris radiata, van Hasselt, of which there is a beautiful figure in Bergh's notes from the Leyden Museum, is probably a *Doridopsis*.

The species of *Doridopsis* are very difficult to diagnose and distinguish, as the colours are remarkably variable, and the internal organs offer few important differences. There is no radula or other buccal armature.

Doridopsis vidua (?), Bergh.

Bergh : Neue Nacktschnecken, iv, Journ. des Mus. Godeffroy, 1878, Heft. xiv, p. 35—6.

A single specimen from La Jolla, July 1901, described by Cockerell as *Doris nigromaculata*, n. sp., without further notes. It is 10 millim. long, 5 millim. high, and 4 millim. broad across the branchiae, but is broader behind than in front. The back is strongly arched, but this shape is perhaps not natural as the animal is bent. The surface is smooth, not tuberculate, and a number of glistening white spicules can be seen imbedded in the skin. They are mostly fairly straight long rods, but some of the smaller ones are bent and have an irregular outline. The colour of the animal, as preserved, is a yellowish-drab with a slight inclination to lilac in places. There is a double border of black spots round the dorsal margin, and a few larger black blotches symmetrically disposed, one in front of the rhinophores, two behind them, two in the middle of the back, and five in front of the branchiae. The rhinophores are large and grayish. The branchial pocket lies far back ; it is wide, open, very shallow, with a transparent floor, and smooth, slightly raised margin. It contains six small scanty greyish plumes, fully everted and set in a semicircle open behind. The anal papilla is large.

The foot is rather broad, rounded at both ends and not projecting behind. The proboscis is protruded and projects from a pore in its anterior margin. No pedal groove or oral tenticles are visible. The mantle margin is everywhere rather narrow.

The internal organs, which are yellowish-white, seem to be as usual in the genus and do not differ from those of *D. vidua* as described by Bergh. No blood gland was discovered. The buccal tube is rather thick and makes an S-shaped bend to the left. The mouth gland is yellowish, folliculate with a fairly long duct. The central nervous system as usual in *Doridopsis*, and with distinct eyes.

The specimen as preserved is remarkably like Garrett's figure (reproduced by Bergh) of *D. vidua*, except that the skin has a more distinctly yellowish tinge and the mantle margin is narrower. Possibly too, the spicules are more numerous and differently shaped. *D. vidua* is recorded from Tahiti, and the locality renders the identification suspicious, as the Californian nudibranchs are not as a rule the same species as those from the South Seas; but the resemblances are so great that I have registered the animal as *D. vidua*. If it ultimately proves to be a separate species, it would seem entitled to Cockerell's manuscript name *D. nigromaculata*.

Doridopsis foedata, Abraham, of unknown habitat, would appear to be a very similar form, but is said to be soft, fleshy, and minutely tuberculate.

Doridopsis reticulata, n. sp.

Pl. vii, fig. 5.

Eight specimens of very various sizes and colours, but apparently belonging to the same species. The living animal is said to have been rather more than 20 millim. long. Many of the preserved specimens are very small, but the largest are 17 millim. × 7 millim., and 14 millim. × 9.5 millim. respectively. They are all very flat and irregular in outline, and can probably alter their shape from long to oval. They were captured at San Pedro, California, and one at anyrate on Dead Man's Island. This specimen, when alive, was of a deep chestnut colour, with very numerous white spots. The branchiae were entirely white, the short thick rhinophores pale orange; the margin of the body was whitish, and the sole of the foot yellowish white.

The preserved specimens vary in colour from yellowish-brown to purplish-brown; in all, the back is covered with small tubercles, which are tipped with white. These white tips and the light mantle border are more conspicuous in the yellowish than in the purplish specimens. The rhinophores are whitish, stout, with about 30 perfoliations and slightly raised sheaths. The branchiae are 5 or 6, conspicuously white and tripinnate. The edge of the pocket is raised, and in most specimens turned outwards. In all, the underside of the mantle is grey, and displays a remarkable clear white reticulation which looks superficially like the branchiae of *Phyllidia*. It appears, however,

to be formed by bundles of fibres and spicules anastomosing irregularly within the transparent skin. The dorsal integuments also contain long intersecting spicules (fig. 5), straight or Y shaped, more rarely curved, and sometimes striated transversely. They are not visible externally, but can be seen from the inside.

The intestines are white or yellow, but the blood gland which is of a deep purple contrasts markedly with its surroundings. It is single and irregularly lobed in outline. The eyes are very large and black; the central nervous system is concentrated as usual in *Doridopsis*, the different ganglia not being distinguishable, except the buccal pair which are set far back on a constriction of the oesophagus about 4 millim. from the rest. Some previous investigator had opened the anterior portion of all the larger specimens, but the arrangement of the buccal parts though disturbed seemed to be that usual in the genus. The oesophagus is narrow, coiled several times, and dilates into a small spherical pouch just before it enters the liver. The latter varies from chocolate to grey in colour, but in most specimens is hidden by the yellow follicles of the hermaphrodite gland. It is deeply cleft behind. The mucous gland is large and folliculate externally; it partially surrounds the large spherical spermatotheca. The spermatocyst is elongate. The ampulla of the hermaphrodite gland is sausage-shaped and very distinct. The glans penis is thickly studded with hamate spines, resembling the teeth of Dorids.

It is possible that this animal is Cooper's *Doris albo-punctata* (Proc. Calif. Acad. Nat. Sciences, 1863, vol. iii, pt. i), but the original type specimens appear to be lost, and the description is so slight that it would hardly be sufficient to identify any species. In some points (e.g. "surface shining, minutely rugose") it is not applicable to the present specimens, unless this phrase is intended to refer to the underside of the mantle, which is not stated. Otherwise, Cooper does not allude to the remarkrble reticulation, nor does he say anything about the conspicous contrast between the white branchiae and the colour of the dorsal surface

Triopha, sp.

One specimen from San Pedro which is much contracted and appears to have lost both its natural shape and colour. As preserved, it is of a uniform grey, 6 millim. long, 3.7 broad and 4 high. There are 8 processes on the frontal veil, and 5 on each side of the body, all low and stout, sub-divided into short thick branches. The branchiae are six; the rhinophore sheaths straight and cylindrical about 1.5 high. The back is quite smooth, and no tubercles are visible.

The jaws are roughly triangular, and composed of short, thick rods of varying shape. The radula is whitish and contains 25 complete rows as well as a few broken ones. There are four rhachidian teeth, very transparent and little developed. The two inner are squarish, the two outer are triangular.

There are only four pleural teeth, of which three are hamate and the fourth low and less perfectly formed. The uncini are 8, and much as described for *Triopha maculata* by MacFarland.

This form does not completely correspond with any of the described species, but as there are no notes on the living animal, and the specimen is ill-preserved and probably immature, it is not advisable to make it the type of a new species.

The known species are :—

1. *Triopha carpenteri*, (Stearns) } MacFarland regards these two
2. *T. modesta*, Bergh. } as distinct.
3. *T. maculata*, Mac Farland.
4. *T. grandis*, Mac Farland.

The genus is recorded only from the west Coast of North America.

Laila cockerelli, MacFarland.

MacFarland: Prelim. account of the *Doridídae* of Monterey, pp. 46, 47.

The type of this form is from Monterey Bay, but numerous specimens obtained by Cockerell agree with it, except that they are smaller, the largest being 12 millim. long and 4 broad. One specimen preserved differently from the others appears to have kept its natural colour. The body is whitish, the the numerous spicula being seen clearly through the skin. The tips of all the papillae are of a deep brilliant orange; the five non-retractile branchiae are tipped with the same colour. The dorsal tubercles and rhinophores are of a lighter yellowish orange.

There are about 30 club shaped papillae on each side of the body arranged in thickly set oblique rows containing 2—3 or rarely 4 papillae each. In the centre of each papilla is a column of spicules, which can be seen through the transparent integuments. Two small tubercles stand in front of the branchiae, and others form a row down the centre of the back with a few scattered smaller ones at the sides. The whole dorsal surface is thickly and visibly spiculous, the spicules being usually swollen in the middle, and sometimes almost cruciform. The frontal veil is wide and prominent, bearing papillae like those on the dorsal margin. The anterior margin of the foot is abruptly truncate. On each side of the front part of the body is a short projecting ridge, situated just below the margin of the mantle and running back a little way from the oral tentacles. No trace of mandibles or a labial armature could be found.

The radula consists in the largest specimens of nearly a hundred rows of colourless teeth. The narrow rhachis, which lies in a rather deep groove, bears a single series of flat quadrangular plates. The innermost tooth is simply hamate, slender and very hard to see. The second tooth is large and strong with two hamate cusps; then follow nine or ten uncinal teeth, flattened

and quadrangular. The inner ones bear one or two cusps, but much lower and less developed than in the larger tooth. The cusp gradually decreases and the 3—4 outermost are mere plates. I did not find more than 10 uncini in any specimen. The verge is armed with small irregularly shaped spines.

This form offers a most curious superficial resemblance to an aeolid. Not only are the papillae set in transverse row, but the spiculous axis which they contain, and which is visible through the transparent skin, looks very like the hepatic ramifications found among cladohepatic nudibranchs. The animal is, however, obviously allied to *Triopha*, but is distinguished from it more clearly than *Issa* and *Triopha* in virture of the arrangement of the papillae, the buccal parts, and the lateral ridges.

Aegires albo-punctatus, MacFarland.

Mac Farland: l.c., p. 45.

One specimen probably from San Pedro, but not to be identified with those in Cockerell's list. Length 10.5 millim.; width across back 4 millim.; across foot 2 millim.; height in front of the branchiae 4.5 millim. The body slopes up to the branchiae and then downwards posteriorly. The head is rather broad, the tail tapering; the integuments are hard and full of spicules, which have mostly the shape of curved rods. The colour is a pale dull yellow, with a few dark spots scattered irregularly here and there between tubercles. These latter are arranged in fairly symmetrical rows, but as there are also tubercles between the rows, the symmetry is not complete. There seem to be three main rows on each side of the central dorsal space, which bears two or three tubercles, and the two innermost unite in front to form one line between the rhinophores. The third line is more or less continuous with the frontal veil, and, as in Alder and Hancock's plate of *Aegires punctilucens*, seems to mark the boundary of the dorsal surface and passes behind the branchiae, but (also as in *Ae. punctilucens*,) there are other rows of tubercles below it, and on the tail to the very end.

The oral veil is rather broad, rounded, and as preserved, is drawn down to the sole of the foot. It bears many crowded tubercles arranged irregularly in 4—5 rows. The tubercles vary in size, the larger being about 1.5 millim high, and are cylindrical with flattish tops, bearing a few minute in conspicuous hispid or spiculous processes. The rhinophores are stout, whitish, completely retracted, and with no signs of perfoliation. The right rhinophore pocket is surrounded by four, and the left by five tubercles, of which the outer are the larger, but there are only slight traces of a common rim connecting these tubercles. The branchiae are small, white, tripinnate and bear 4—5 main ramifications. Before each of them stands a large tubercle which bends over the plume, without closing over it as in *Notodoris*. The anterior tubercle is deeply three-lobed; those at the sides four-lobed.

The intestines are whitish, except the liver which is grey, The central nervous system appears to be much as in *Ae. punctilucens* as figured by Bergh.

The buccal mass contains a circular armature of rather thick rods of various shapes, some bent. In the roof of the mouth is a single mandible, bright yellow and roughly square in shape with a blunt triangular point on the cutting edge. The hinder part of it is membranous. The radula is colourless, and consists of 17 rows containing 18 hamate teeth on each side. Near the rhachis they are smaller and crowded, the hook is low and the base long. They increase in size outwards up to the last but one The outermost of all is rather smaller. They have a wing-like process on the inner margin.

As *Aegires albo-punctatus* is recorded from the Californian coast, the present animal should probably be referred to it, though points of difference are not wanting. The loss of the white dots in a preserved specimen is not surprising, but there are also differences in the shape of the oral veil and branchial valves. But in nudibranchs which bear tubercles and processes these organs exhibit great variation, and it would be unsafe to assume that the arrangement found in a single specimen is specifically characteristic. It is assumed that in saying the pleural teeth of *Ae. albo-punctatus* are similar in form, Mac Farland does not mean to say that the inner ones are not smaller than the rest, as is usual in the genus.

The various species of *Aegires* are not sharply distinguished, and neither this specimen nor the typical *Ae. albo-punctatus* differ materially from *Ae. punctilucens*, except in colour.

The forms hitherto described are :—

1. *Ae punctilucens*, d' Orbigny.
2. *Ae. hispidus*, Hesse.
3. *Ae. leuckartii*, Verany.
4. *Ae. albo-punctatus*, MacFarland.
5. *Ae. villosus*, Farran.

Dirona, Mac Farland, MS., nov. gen.

Though the following will probably be the first printed account of this remarkable genus, I learn from Prof. Mac Farland, who has most courteously supplied me with much valuable information, that he has been able to prepare a much fuller description based on the examination of many living animals and preserved specimens. It would appear that some time may elapse before his paper is issued, and I, therefore, publish the following notes, which are necessarily imperfect on account of the scantiness of the material at my disposal, but at the same time I preserve his generic and specific names.

The generic characters are as followes :—The animal is aeolidiform in appearance and bears papillae of various sizes, sometimes studded with knobs and ridges, but not containing cnidocysts or hepatic diverticula. It has no oral tentacles, but perfoliate rhinophores without sheaths, and an oral veil without projections. The anus lies on the right side very far back The jaws are large and smooth. The radula consists of several rows of five teeth each ; the central tooth is small ; the first lateral denticulate, the second

lateral smooth with a large base and a large sickle-shaped hook. The liver is trilobed, but is wholly contained within the body cavity, and is not ramified. The hermaphrodite gland consists of several separate lobes lying on the front part of the liver. According to MacFarland, the glans penis is armed.

In some respects, such as the structure of the frontal veil and of the hermaphrodite gland, this animal resembles *Scyllaea*, and perhaps the knobs on the papillae may represent branchiae. In others, particularly the absence of rhinophore sheaths, it approaches the *Aeolids*, and in general appearance is not unlike *Proctonotus*. But the undivided liver is remarkable in conjunction with the other characters, and both the position of the anus and the dentition are peculiar.

The genus will probably be made the type of a new family. At present two species are known:—

1. *Dirona picta*, Mac Farland, California, described below.
2. *D. albolineata*, Mac Farland, California. Prof. Mac Farland states that this animal is of a beautiful, translucent grey, save for a narrow band of pure white edging the veil, the cerata, and the caudal crest; also a similar line running down the stalk of each rhinophore and meeting in the median line. Cerata smooth, radula about 32 × 1. 1. 1. 1. 1.

Dirona picta, MacFarland.

Pl. vii, figs. 6—11.

The animal which was obtained at Dead Man's Island, San Pedro, measures 19 millim. in length and 7 in breadth: the height to the dorsal surface is 5 millim. and to the tip of the highest papilla 9. The length includes the buccal mass which is everted. The colour is whitish but the greenish viscera can be seen through the integuments, and the back and sides show traces of reddish brown pigment. The living animal is described as having brown sides with rather sparse, small, yellowish spots. From a sketch of the dorsal markings it would appear that yellow predominated in this region and that the brown colour was represented only by a reticulate pattern (figs. 6 and 7).

The animal is stoutly built. The foot is broad and slightly expanded in front, where it is rounded, without a groove or lateral angles. The back is flat and minutely tuberculate. The margin is not prominent but is marked by a line of papillae of which there are about 15 on each side and one or two over the tail. They are mostly minute but some are as much as 2 millim. high. The line is generally single but double in some places. Besides these papillae there are a number of much larger ones about 4 millim. high, many of which have become detached, so that it is difficult to be certain what was the original arrangement, but it would appear that there were about 5 on each side within the line of smaller papillae, and that the largest of all were at the end of the body. They are deciduous, somewhat

ovate in shape (4 millim. × 3 millim.) constricted at the base but tapering suddenly to a pointed tip, though this feature is not visible in the drawing. On the inside they bear a number of small prominences, at least two rows of ten each, connected by ridges. The structure is not very plain but may represent some form of branchia though this is not suggested by Cockerell's sketch (fig. 8).

In front of the rhinophores is an oral veil, 1-5 millim. wide at its broadest part. It is undulated but shows no processes or distinct tentacular prolongations. There is no trace of tentacles near the mouth. The rhinophores are stout (3 millim. × 2 millim.) and deeply but somewhat irregularly perfoliate. They are much contracted but look as if they had originally had a process or sharp point in front. They have no sheaths and are apparently not retractile, for though there is a slight hollow at their bases it looks as if they could not be withdrawn into it. The genital orifices are about 3 millim. behind the frontal veil, inconspicuous and without folds. The vent is at the extreme posterior end of the right side. It is very wide but not very prominent.

The central nervous system is yellowish and very distinctly granulated. The eyes are large, black with a reddish lens and set on long stalks. The cerebro-pleural ganglia show a very distinct division: in fact in the preparation the two parts are separate, but this is perhaps not natural. The pedal ganglia are below them and applied to the sides of the oesophagus.

The jaws are yellow, not denticulate, and apparently bear three ridges, arising near the hinge. They seem however somewhat crumpled and perhaps have been injured owing to the eversion of the buccal mass. The formula of the colourless transparent radula is 22 × 1. 1. 1. 1. 1. In the middle of the wide naked rhachis is a small elongate central tooth (fig. 9) bearing a longish straight spine. With the highest power, traces of one or two denticles seem visible at the base of this spine in some teeth, but they are very small. The first lateral (fig. 10), which is a considerable distance from the central tooth, is somewhat as in *Coryphella*, hamate, with a longish base and 6-8 distinct denticles. The second lateral (fig. 11) has a very long base and a large curved hook, blunt and not denticulate.

The oesophagus passes under and into the liver, which is dark green, and appears superficially to be a single solid mass, but on examination is seen to be trilobed, one of the lobes being slightly bifid. No diverticula or branches are visible, though there are holes in the surface of the liver whence they might have issued. But no diverticula can be detected in the papillae by either sectioning or squashing. The substance of the papillae seems to be homogeneous and only slightly yellower in the centre than outside. It is certain that they do not contain a column of green substance analogous to the liver. No cnidocysts could be found. Enclosed in the liver is a thin, membranous, almost transparent stomach with a few internal laminae. This and the intestines are full of gritty matter and many small

spines, which may either represent a stomachic armature or be merely the remains of some animal which has been swallowed. They were not observed in any place to be clearly arranged on the walls of the stomach. The liver is deeply grooved to receive the intestine which is whitish. It runs low down at the side of the liver and turns upwards at the end of the body.

On the anterior surface of the liver are seven yellowish grey lobes which appear to constitute the hermaphrodite gland though they are so much hardened that the structure cannot be clearly seen. In any case they do not form a layer over the liver, nor do they extend to the posterior part of the body cavity. The genitalia are not well preserved, and, as it would seem, not fully developed. The mucous gland is of moderate size and the spermatotheca appears to be elongate. The distinct, yellowish renal syrinx lies at the side of the intestine.

Prof. MacFarland informs me that this species found by Mr. Cockerell at San Pedro is common at Pacific Grove. The living animal is of a light brown, plentifully besprinkled with fine lemon yellow spots, and with a single pink spot at the base of each papilla. The shape of the living animal is represented in figure 8a. In alcohol it becomes unnaturally high and square and the thin expanded edge of the foot is lost It further appears from Prof. Mac Farland's notes that the glands penis is armed but not the stomach, so that the spines found by me must be part of some animal which had been eaten, and that the undivided character of the liver is constant in all specimens.

Janolus, Bergh.

This genus, which was created by Bergh for *Janolus australis* obtained by the Challenger in the Arafura Sea, differs from *Antiopella*[1] *(Janus)* in having large smooth jaws and a very wide foot with an expanded margin. *Antiopella hyalina* has been shown by Bergh to be referable to this genus and a new form is here described, so that the known species are :—

1. *Janolus australis*, Bergh.
2. *J. hyalinus* (A. & H.).
3. *J. coeruleopictus*, n. sp.

Janolus coeruleopictus, n. sp.

Pl. viii. figs. 12—16.

Found at Dead Man's Island, San Pedro, California. The notes on the living animal say that it looked like a mass of speckled jelly, and that the cerata were very easily deciduous. The colours are to be gathered from the sketches (figs. 12, 13).

1. For this nomenclature *(Antiopella = Antiopa = Janus)* see Hoyle, Journ. of Conchology, 1902, p. 214.

The single preserved specimen is stoutly built. It measures 7 millim from head to tail, but this represents at least 10 millim., as the body is considerably bent. The height is 4 millim., the breadth 3.5 across the back and 5 across the foot. The buccal mass is exserted and the anterior end of the animal somewhat distorted, but there appears to have been a fold over the mouth with a distinct cylindrical tentacle on each side. Behind this are the rhinophores, large, stout, almost spherical, 2 millim. high, with about 15 deep perfoliations and slight cavities not amounting to pockets at their bases. Between them is a crest which may be described either as two tubercles, or one tubercle indented in the middle. The body bears at present only a single line of minute cerata, which are evidently in the first stage of growth. There are 25—30 on each side, and about six in front of the rhinophores. Loose in the bottle are five stoutish conical cerata 3.5 long, with a yellow ring below the tip. Their outline is rather irregular but they do not bear distinct knobs. I have seen living specimens of *Antiopella cristata* at Plymouth in a similar condition. In the *Janidae* the cerata are very caducous and easily lost but also easily renewed. It is probable that the present animal in its perfect state was covered with cerata similar to the large ones now detached.

The anal papilla is large and cup-like, medio-dorsal and behind the pericardium. The genital orifices are far back and surrounded by moderately strong folds. The verge is exserted, very long, nearly 4 millim., conical but sinuous, pointed but unarmed. The foot is broad, straight in front ; no notch or groove is visible, but it was perhaps connected with the lateral expansions of the head, though it is hard to tell from the preserved specimen. The lateral margins of the foot are ample and undulated. The tail is not long.

The buccal mass is long and rather compressed. Its sides are enclosed by the yellow jaws. They are very large for the size of the animal (length 3.5, breadth 1.7), triangular, with a ridge down the middle of each side, and striated. The edge is not denticulate, but presents a minutely tessellated appearance near the hinges. The radula consists of sixteen rows, and the maximum formula appears to be $16 \times 27.\ 1.\ 27$. The teeth are transparent, much bent and crowded, especially near the rhachis. It is probable that there is a median tooth in all the rows, but owing to the crowding and irregularity of the other teeth it is often impossible to discover it. The teeth are stout, low and hamate near the centre of the rows (figs. 14, 15), and have long bases. Further from the rhachis they become taller, more slender with smaller bases and more erect (fig. 16), only the outermost being again short. On a few teeth near the rhachis can be seen 3—4 small ridge-like dentacles quite at the base of the hook. The remaining teeth are smooth.

The internal organs are not well preserved. The alimentary tract could not be satisfactorily traced, but as far as it could be followed seemed to correspond with the descriptions of *Antiopella cristata*. The cerata contain yellowish diverticula which bear two or three knobs or branches at the tips, where the yellow rings are visible externally. The hermaphrodite gland is large, and

consists of many white follicles; the mucous and albumen glands large; the spermatotheca strong and rather elongate. The central nervous system is very strongly granulate; the cerebro-pleural ganglia are elongate, the pleural rounder.

Hermisenda opalescens (Cooper).

Bergh: Explor. of Alaska, Nudibr. I, p. 138.

Cockerell is probably correct in referring to this species, a number of specimens found at San Pedro and in regarding it as identical with the *Eolis opalescens* of Cooper from San Diego, although Bergh's specimens from Alaska were much smaller and there were some discrepancies in colour.

This nudibranch was found abundantly on mud flats at low tide in San Pedro harbour on July 19, 1901, and attained a length of 42 millims. The papillae were arranged in thick groups and were deciduous The tentacles and sole of the foot were of a beautiful opalescent blue and a stripe of the same colour ran down the middle of the back, bifurcating anteriorly so as to enclose an oblong area of bright orange. In some individuals there was a similar orange area in the middle of the back. Some pink internal organ could be seen through the integuments, and there was a broad orange stripe on each side of the head passing backwards from the oral tentacles. The cerata were yellowish with bluish tips, and the hepatic diverticula varied in colour from purplish to very pale brown, the lighter colour being the commoner (figs. 17, 18, 19).

The preserved specimens are of a uniform pinkish or violet grey; the length varies from 15 to 20 millim., the breadth across the cerata at the widest part from 7 to 9. The external and internal characters seem to agree with Bergh's description, allowing for the difference of size.

The cerata are set in four or five thick groups, of which the first and second are somewhat raised, the others less distinctly so. The innermost cerata are largest, the outermost very small. The foot is broad, thickened and grooved in front, and produced into grooved tentacular angles. The tail is long and thin, extending 5 millim. behind the cerata in large specimens. The rhinophores bear about 20 distinct perfoliations. In several specimens the oral tentacles simulate perfoliation in a remarkable manner, but the phenomenon is apparently due to contraction as in other specimens they are smooth and simple.

The jaws are yellowish and bear a line of pointed denticles which are themselves serrulate in the hinder part. The radula consists of about 25 yellowish teeth with 4—6 longish, curved denticles on each side of the central cusp. These denticles are sometimes irregularly shaped or bifid. The under side of the central cusp is irregularly serrulate, the serrulations, though not always easy to see, amounting to at least ten. Bergh mentions that a layer of rather short sacculate glands filled the end of the penis

around the orifice. In some of the present specimens the organ is exserted, and it seems clear that there are four or five rows of round glandular nodules at the base of the terminal portion, set about one third of the way down the whole organ, which is very long. The circuit is interrupted in one part by a triangular flap of skin which itself bears nodules.

In this genus the denticles on the edge of the jaw are themselves serrulate, and the central cusp of the teeth is serrulate on the under side, both of which characters (though referring to somewhat minute details) are unique in the hitherto described *Aeolidiadae*. Otherwise the *Hermissenda* is closely allied to *Facelina* and *Facalana*, and and perhaps the three should be regarded as a single genus. The round glands on the verge recall those found on the same organ in *Facalana*.

Spurilla, Bergh.

This genus resembles *Aeolidiella* in its general shape and bilobed, pectiniform teeth, but differs in having perfoliate rhinophores, though there would seem to be a rudimentary perfoliation in some species of *Aeolidiella*. For instance, Vayssière states that the rhinophores of *Ae. glauca* are "munis d' un sillon spiral." Four species of *Spurilla* are known, namely :—

1. *Sp. neapolitana*, (Delle Chiaje).
2. *Sp. sargassicola*, Bergh.
3. *Sp. inornata*, Vayssière.
4. *Sp. chromosoma*, n. sp.

Spurilla chromosoma, n. sp.

One specimen from Deadman's Island, San Pedro, where it is said to be found on rocks between tides. According to the notes on the living animal, the body is of a ruddy colour, with a row of white marks on the back, the cerata greenish with white tips, and the oral tentacles remarkably strong and large. It is mentioned that the cerata are easily deciduous, and they are almost entirely lost in the preserved specimen. It is much bent, but would be about 15 millim. long if straightened out, stoutly built but with a long tail. Traces of the ruddy colour can be seen in the anterior part of the body. The anterior corners of the foot are considerably produced but bent downwards. The oral tentacles are still unusually long and stout. The short, thick, pinkish rhinophores bear about ten oblique perfoliations. It is not possible to say what the arrangement of the cerata was. The few that remain are very small.

The buccal parts are everted, and the interior of the cavity is seen to be covered with small tubercles. The jaws are yellow and no denticles could be found. The radula consists of 19 yellow pectiniform teeth, distinctly bilobed and arched, not flat. There are one or two central denticles lower than the rest, and on each side of them from 25 to 32 long, thin lateral denticles, the points of which are often broken off. No genital armature was found.

This animal approaches very nearly *Sp. neapolitana* which has a similar coloration, large oral tentacles and transversely laminated rhinophores. The teeth, however, and the front part of the foot present differences, and in view of the habitat the probabilities are in favour of the species being distinct. But the close resemblance between several Californian and European nudibranchs is remarkable.

Phyllobranchopsis, nov. gen.

The specimens on which this new genus is founded are so badly preserved that many important characters remain uncertain. With the aid of Mr. Cockerell's sketch however (figs. 20, 21) the followlng points can be established. The radula is ascoglossan and closely resembles that of *Hermaeina*, Trinch.; there are no jaws and no oral tentacles: the rhinophores appear to be as in *Hermaea*: the margins of the back bear one or two rows of flat leaf-like appendages, as in *Phyllobranchus*. The digestive system and hepatic diverticula seem to be as in *Hermaea* and no trace of a buccal crop can be found, though in view of the maceration of many of the internal organs, its absence cannot be regarded as conclusively demonstrated. The vent could not be found.

The animals offer many resemblances to *Caliphylla*, but differ in (1) their stouter shape, (2) the small number of cerata, (3) the radula, (4) the arrangement of the hepatic diverticula in the cerata, and (5) the apparent absence of the crop. It appears best to regard them as a new genus belonging to the *Hermaeidae*, but in many ways intermediate between that family an the *Phyllobranchidae*.

Phyllobranchopsis enteromorphae, gen. and spec. nov.

Pl. viii, Figs. 20—22.

Four specimens found on Enteromorpha in small rock pools near high water mark or Dead Man's Island, San Pedro, July, 1901. The living animals are described as greenish yellow, with black mottlings on the sides. The eyes were very distinct and set on small pale patches, the head and and neck being black. The animals were about 5 millim. long.

All the specimens are badly preserved and much macerated, so that it is impossible to be certain about many of the most important external characters. They are all greenish-white with an irregular black marbling, distributed in varying proportions on the sides, head, tail and rhinophones, but not on the foot or back. The cerata are whitish and flat as in *Phyllobranchus* with sinuous but not denticulate edges. The largest are 2 millim. long and 1 mlllim. wide. They appear to be arranged in a single row, but large and very small cerata are sometimes found close together and may represent two rows. They are easily caducous and many have fallen off. Within them can be seen greyish cells, only slightly darker than the surface

Huth, Lith^r. London

CALIFORNIAN NUDIBRANCHS.

Huth, Lith^r London.

CALIFORNIAN NUDIBRANCHS.

tissue arranged in a loosely ramified flocculent pattern. They also contain large white cells and in some cases a few bands of purplish cells.

The foot is as broad as the body (not divided transversely) somewhat expanded in front and with a thickened anterior margin. It extends a little in front of the mouth which cannot be seen ventrally. The tail is pointed but not very long. No oral tentacles could be found. The rhinophores are injured but appear to be pointed as in *Hermaea*. The pericardium is not equally prominent in all specimens, but appears to be oval.

The eyes are large and distinct: the ganglia of the central nervous system are granulate, but their arrangement could not be clearly seen. The buccal mass is rather small, white and not striated. No sign of jaws or crop could be seen. The number of teeth in the radula (fig. 22) varies from 35 to 56. They are arranged in a spiral of about 4 coils, the used teeth retaining their position and not falling into a heap. The size increases rapidly going backwards. In the largest radula there are 4 rudimentary teeth without a hook, 15 small, 12 moderately large, and 25 full sized. All but the rudimentary teeth have a deep indentation in the back and a spoon-shaped cavity at the end, across which runs longitudinally a thin lamina bearing a row of numerous fine denticles. They closely resemble those of *Hermaeina maculosa*, Trinch. No armature could be found in the reproductive organs.

C. Eliot.

DESCRIPTION OF PLATES VII. & VIII.

1. *Tritonia palmeri.* *a.* Median tooth, *b.* first lateral.
2. „ „ An ordinary lateral tooth.
3. *Acanthodoris rhodoceras.* Elements of labial amature.
4. „ „ „ Half a row of the radula. *a.* first lateral, *b.*—*f.* remaining laterals.
5. *Doridopsis reticulata.* Spicules.
6. *Dirona picta.* A living specimen which has however lost most of its cerata.
7. „ „ Dorsal markings.
8. „ „ One of the cerata.
8A. „ „ Living animal, drawn by Prof. Mac Farland.
9. „ „ Median tooth. *a.* from below, *b.* from side.
10. „ „ First lateral.
11. „ „ Second lateral.
12. *Janolus coerulcopictus.* Living animal without cerata.
13. „ „ Two cerata.
14. „ „ Teeth near the rhachis.
15. „ „ Teeth nearer the centre of the half row.
16. „ „ Teeth nearer the end of the row.
17. *Hermissenda opalescens.* Animal from above without cerata.
18. „ „ Animal from below.
19. „ „ Two cerata.
20. *Phyllobranchopis enteromorphae.* From the side.
21. „ „ „ From above.
22. „ „ „ Radula.

THE GENUS CATAULUS, WITH DESCRIPTIONS OF NEW FORMS.

By E. R. SYKES, B.A.

Some years ago I gave (Proc. Malac. Soc., vol. iii, p. 66) a list of Ceylon forms of this genus known to me.

Recently I have examined the greater portion of the specimens belonging to this group which formed part of Hugh Nevill's collection. Several species appeared to me undentifiable with any known form, and a few of these have recently been described by Mr. Fulton, unfortunately without any figures. Four new names are now proposed, and I thought it might be of interest to bring the list of Ceylon forms that I published some seven years ago up to date. Since that time the generic name has been discussed by Dr. Kobelt and myself (1), and a note on the anatomy has been published by Miss Digby (2); the residue of the notes are referred to directly in the following pages.

Insular faunas are prone to include a number of closely related forms belonging to a single group and the problem of the specific value of these forms is an exceedingly difficult one. Until the anatomical characters of the races of *Cataulus* are investigated, the decision as to whether characters found in the shells are varietal or specific must be based on general experience in dealing with specimens and also from a comparison of fairly lengthy series.

The figured specimens are in my collection.

Cataulus aureus, Pfr.,

In my paper I placed *C. leucochilus*, (Ad. and Rve.) Sby., as a synonym. Recently a number of specimens of the form now described as *C. smithi* have been distributed under this name and I have therefore again investigated the matter. I feel no doubt that my original decision was correct and that the figure given by Sowerby—no description having ever appeared—was taken from a specimen of *C. aureus*, very probably one of those in the British Museum. It may be remarked that the name *aureus* does not occur in Sowerby's list, and the Museum tablet has been so labelled in fairly recent times, having previously born the appellation of a variety of another species. Very possibly Sowerby noticed this and perceiving it was erroneous, he published the name *leucochilus*.

1. Thierreich, Cyclophoridae, p. 281 ; J. Malac., Vol. x, p. 2.
2. Proc. Malac. Soc., Vol. v, p. 261.

Cataulus austenianus, Benson.

Cataulus blanfordi, Dohrn.

In my view *C. connectens*, Fulton (J. Malac, x, p. 602) is only a local race with a yellow peristome: indeed I have specimens, which I am unable to sever from this species, in which the usual dark red peristome is here white.

Cataulus congener, n. sp.

Cataulus colletti, Sykes.

Cataulus decorus, Benson.

Cataulus eurytrema, Pfr.

Cataulus greeni, Sykes.

C. greeni, Sykes: J. Malac., vii, p. 30.

Mr. Fulton has (J. Malac., x, p. 102) described a var. *robusta*.

Cataulus haemastomus, Pfr.

A variety occurs with a white lip.

Cataulus layardi, (Gray) Pfr.

Cataulus marginatus, Pfr.

Mr. Fulton has described (Ann. Nat. Hist., ser. 7, vol. xiii, p. 453) a variety *crenulata*. I take this opportunity of describing a remarkable variety.

Cataulus nevilli, Sykes.

Mr. Fulton has described (l.c.) a var. *flaveolabris*.

Cataulus nietneri, Nevill.

Two varieties, *unicolor* and *caperata*, were recorded by Collett (J. Malac., vol. vii, p. 85).

Cataulus prestoni, n. sp.

Cataulus pyramidatus, Pfr.

The two forms mentioned by Pfeiffer, seem to occur in all collections.

Cataulus rugosus, Fulton.

Cataulus rugosa, Fulton: Ann. Nat. Hist., ser. 7, vol. xiii, p. 452.

Cataulus smithi, n. sp.

Cataulus sykesi, Fulton.

Cataulus templemani, Pfr.

Cataulus thwaitesi, Pfr.

I am unable to clear up the relationships of this form with the shells described by Pfeiffer under the names of *cumingi* and *duplicatus*, but I incline still to the view that all three are probably varying forms of one species.

DESCRIPTIONS OF THE NEW FORMS.

Cataulus smithi, n. sp.

(Fig. 1.)

Shell deeply rimate, solid, straw-yellow, the protoconch a trifle darker, pyramidal, with the spire well raised; the earlier whorls smooth, and the residue sculptured by numerous, closely set, fine longitudinal costulae; suture well impressed; whorls 8, plano-convex, the last being a little compressed in front; umbilical region large, sculptured as the rest of the shell; the umbilical carina is large and distinct, with a second smaller one within; lip white, continuous, sub-circular, slightly projecting at the base, reflected, most noticeably so at the lower outer margin, canal large.

Alt. 26.5; diam. max. (of end whorl) 10.5 millim.

As compared with *C. aureus* the present shell is straw-yellow and not golden-yellow in colour; it is much larger with flatter whorls, the mouth is sub-circular and lacks the angle at the upper right-hand margin, &c. From *C. austenianus* the shape and colour of the mouth and lip, as also the elongate form, will suffice to sever it: similar vaaiations distinguish it from the white-lipped var. of *C. haemastoma*. I would lay stress on the second carina at the base.

The name is given as a trifling recognition of the assistance that Mr. Edgar Smith has always so readily given me on any difficult point.

1.

Fig. 1.—*Cataulus smithi*, n. sp. × 1½

2.

Fig. 2.—*Cataulus prestoni*, n. sp. × 1½.

Cataulus prestoni, n. sp.

(Fig. 2.)

Shell nearly related to *C. aureus*, but differing in the following characters. Colour straw-yellow rather than golden-yellow; size smaller; whorls not so inflated; umbilical region more rounded; lip not so produced at the base, not so much reflected, and not so 'winged' at the upper right margin; canal smaller.

Alt. 20.8; diam. max. (of last whorl) 8 millim.

Dedicated to Mr. Preston, in acknowledgment of his courtesy in placing at my disposal all the specimens of *Cataulus* he acquired of Hugh Nevill's.

Cataulus marginatus var. **notata,** n. var.

(Fig. 3.)

Shell larger than the typical form; shape more pyramidal; whorls more flattened; longitudinal striation almost absent; the malleation in the variety is much stronger, especially on the last half of the last whorl, where a second carina, above the normal one, is often present, leaving a smooth area between them; mouth duplex, pale flesh colour.

Alt. 17; diam. max. (last whorl) 5.5 millim.

3.

Fig. 3.—*Cataulus marginatus* var. *notata*, n. var. × 2.

4.

Fig. 4.—*Catalus congena*, n. sp. × 2.

Cataulus congener, n sp.

(Fig. 4.)

Shell elongately pyramidal, rimate, yellow, becoming tinged with red-brown on the earlier whorls, these latter are smooth, while the rest of the shell is closely, finely, longitudinally striate; suture well impressed; whorls $7\frac{1}{2}$, convex; umbilical region moderate in size, sculptured as the rest of the shell; aperture sub-circular; lip white, double, the outer part well reflected and thin at the edge, slightly produced at the right upper margin, the inner part circular and produced; basal canal small, the carina being whitish.

Alt. 16.5; diam. max. (last whorl) 6 millim.

Resembling in form a dwarf *C. aureus*, but separable by *inter alia*, the shape of the outer lip, and the duplication of the lip as also by the small basal canal.

BIONOMICAL CONSIDERATIONS IN GASTROPOD EVOLUTION.

By J. R. AINSWORTH DAVIS, M.A.,

Professor of Zoology in the University College of Wales, Aberystwyth.

Without pre-judging the question of Molluscan affinities, or speculating in detail on the characters of the "Archi-Mollusc," there seems good reason for believing that this was a flattened, fairly elongated, creeping type, unsegmented, and probably devoid of an extensive coelom. The creeping habit would be associated with a tendency to increased muscularity of the ventral body-wall, while—as a protective adaptation—the dorsal integument would be more or less strengthened by calcareous secretion. Whatever may have been the exact nature of the "prae-archi-mollusc" it almost certainly respired by the general surface of the body, and as the gradual specialization of both ventral and dorsal surfaces in the manner indicated must have involved a reduction in respiratory efficiency, it is easy to conceive the *pari passu* development—by the selection of favourable variations—of dorso-lateral folds of integument, as a means of compensation. We are thus enabled to construct a plausible hypothesis of the way in which the inception of two primary Molluscan characters—i.e. muscular ventral body-wall and skeletogenous dorsal integument—naturally led to the acquisition of a third characteristic feature—the possession of a *mantle*. The space roofed over by the mantle flaps would be the *mantle cavity*, part of this being destined to deepen into a *branchial cavity* at a later stage in evolution. From some such type as that partially described it is easy to derive the Placophora (*Chiton*, &c.) by further specializations; and perhaps the Aplacophora (*Proneomenia*, *Neomenia*, *Chaetoderma*, &c.) may have arisen from an earlier stage in the evolutionary history of such a type, though the possibility of degeneration must here be taken into consideration.

The lines upon which *Chiton* has evolved have evidently been determined by the habit of clinging to stones, and creeping slowly over their surface to browse upon adherent algae. The comparative length of the foot suggests that it has to do a good deal of creeping, and the observation of living Chitons in aquaria proves that this is actually the case. It is with the upward transitions from the Chiton-type that this article proposes to deal.

Those who have watched the slow progress of a *Chiton*, and compared it with the relatively agile Periwinkle (*Littorina littorea*), cannot fail to have realized that the more primitive animal is undoubtedly delayed in its movements by the fact that shell, viscera, and foot, are all practically co-extensive for the entire horizontal extent of the body. And we can

understand the evolution of forms creeping with greater rapidity, by the selection of variations tending to the aggregation of the viscera away from the muscular foot. Hence most probably the development of the "visceral hump", which plays such an important part in Molluscan morphology.

In some of the descendants of the Chiton-type (not of the Chitons, which of course have specialized along their own lines), the acquisition of a more actively creeping habit would seem to have been associated with the development of such a hump, postero-dorsal in position, but as life beneath stones necessitates a considerable amount of lethargic clinging, we may suppose the hump to have been symmetrical and median. Some of these forms were also probably acquiring the widespread habit—especially among Gastropods – of creeping against the surface-film of fairly still water, with their bodies immersed, and in such forms the symmetrical disposition of the main weight of the body, i.e. of the visceral hump, would be accentuated. For here again we have a variety of the clinging habit, and as the creeping organ which supports the weight is necessarily symmetrical about the axis of progression, the weight itself must also be symmetrical. Otherwise a couple would be brought into existence, tending to turn the animal out of the plane in which its foot could cling.

Other types, probably coming off nearer the root of the Molluscan evolutionary tree, would seem to have extended their wanderings from their first home on the under side of stones to the floor of the spaces underneath the boulders of the shore, afterwards leaving the surface and ploughing their way into the gravel, sand and mud. We may thus picture the first beginnings of the Pelecypoda, which have acquired their characteristic shape—as is generally admitted—by a narrowing and deepening of the primitive Molluscan body. The burrowing Scaphopoda probably arose from the stage in which a postero-dorsal visceral hump had already degun to develop, and the gradual hypertrophy of the anterior musculature is readily intelligible.

We will now return to the Chiton-type in which the viscera were collecting into a symmetrical postero-dorsal visceral hump. This probably possessed a protective covering in the form of a cap-shaped shell, beyond which the foot stretched freely backwards, the upper surface of this posterior extension beginning to be chitinized as a protection against the rubbing of the shell-edge, and presenting the first stage in the evolution of an operculum, though as yet with only one of the functions of that organ. Such a type would be able to creep with fair activity, not only under but also around and upon boulders, and it would probably also make use of surface-tension for crossing fairly still tide-pools. A type like this may be imagined as corresponding to the common stock from which both Cephalopods and Gastropods have originated. The creeping by surface-tension was probably associated with a certain amount of para-chuting--when the hold of the surface-film was lost—and in this may very

likely be seen the first beginning of the swimming-habit, which is now so characteristic of Cephalopoda. The long axis of the visceral hump was already directed postero-dorsally away from the head, and the body would tend to dispose itself symmetrically about this incipient swimming-axis, in the most convenient manner for swimming. Extensions of the body diverging from the axis would gradually diminish, and this enables us to understand the disappearance of the foot-sole, with concomitant hypertrophy of the ventral musculature below and around the mouth. It is very probable that there were lateral muscular extensions, possibly of use for parachuting, and most likely also of sensory value. These extensions have persisted in the Cephalopods as the *funnel*, and in many Gastropods as *epipodia*. It is interesting to observe that the "parapodia" of *Aplysia*—regarding the morphological value of which no opinion is here expressed—are lateral muscular flaps used both for parachuting and swimming. The main lines of adaptation—as regards external form—have now been briefly sketched out for the prototypes of the Cephalopoda, and a similar attempt will next be made for the Gastropoda. It is necessary to begin by an account of the probable general lines of evolution of the branchial cavity.

The blood-stream of primitive Molluscs flowed forwards in the gut-wall to the head—the most important region—so that a deficiency of blood was continually being created just beneath the postero-dorsal integument, to which there would, therefore, naturally be an inflow from the other parts of the body. For this reason the posterior integument on either side of the middle line—in the region of the rectum and anus—early acquired special respiratory value, though the present writer does not attach any particular importance to the exact homologizing of respiratory outgrowths in different types. At any rate, as general width was reduced as the outcome of a more active habit, there was a specialization of such outgrowths at the back, and one or two gills (ctenidia) increased in size, that part of the mantle-cavity sheltering them deepening *pari passu*, and becoming a true *branchial cavity*.

The anus was median and posterior, remaining so notwithstanding the development of a branchial cavity. The incurrent respiratory water-streams, coming in on the sides bathed the ctenidia, and then coalesced into an excurrent stream, flowing past the anus, and flushing the branchial cavity. Whatever the exact original position of the excretory openings, it was at any rate more or less posterior, and not very far from the anus. By selection of variations these openings were gradually shifted back towards the median plane, i.e. nearer the excurrent stream, by which their deleterious products were washed away. It is characteristic of Cephalopods that the left side is of predominant importance as regards sexual products, i.e. the one gonad when—as in most cases—only one exists, is the *left*. The same is true for Gastropods, where the gonad primitively expels its products through the morphologically left kidney, so that the excretory outlet of the gonad-possessing side, i.e. the left, must have been of predominating importance.

Since the branchial cavity was not very wide, the excreta would tend to soil the gills to some extent, especially in forms which came more or less out of the water, or were left uncovered by the tide, so that the respiratory streams—and consequently the flushing of the branchial cavity—were temporarily suspended. The left side being predominatingly excretory the gill of that side would naturally be more soiled than its fellow, which would acquire added importance in this way. If now the branchial cavity were shifted even to a very small extent up the right side of the animal, the more important right ctenidium would be correspondingly raised, and thus freed to some extent from pollution. The consequent loss of symmetry would be of no great moment to a form creeping out of water or, generally, over rocks and weed.

An upward shifting to the right would also be of advantage in another way. For a symmetrical postero-dorsal visceral hump would tend to lag behind, bringing the edge of the shell down on the chitinized upper surface of the hind foot, and thus partly or completely closing the opening of the branchial cavity. We find therefore those variations were selected which have ultimately raised the branchial cavity up the right side to the antero-dorsal region of the body.

The earliest Molluscs undoubtedly clung to the rocks as a protection against the wash of the tide and the buffeting of the waves, but this became more difficult as the evolving Gastropods began to wander actively over reefs and boulders. Under these circumstances the habit seems to have gradually become more marked of retracting as much of the body as possible into the cap-like or slightly symmetrically coiled shell. The head would be first drawn in, to be followed by the front part of the foot, but the posterior extension of that organ would be too long to be simply drawn in, and would therefore be flexed on itself, its chitinized dorsal surface thus coming to lie in the mouth of the shell. From this stage onward the gradual specialization of the chitinized area into an operculum must necessarily have followed, and it would seem that we are justified in regarding this structure as a very ancient one.

We know that the shifting of the branchial cavity profoundly modified internal arrangements, and greatly disturbed their original symmetry, so it is possible that the external symmetry was simultaneously affected. As the branchial cavity was shifted in a counter-clockwise direction, it is likely enough that at least the outer whorl of the slightly coiled shell acquired somewhat of a tilt to the left. External symmetry, however, would probably not be greatly modified at this stage, as the still important clinging and—probably—surface-tension creeping habits would militate againt large alterations of the kind.

The early Gastropod was attached to the cap-shaped shell by means of a muscle taking origin in the apex of the latter. But as the branchial cavity shifted and many of the viscera moved or twisted round with it, this muscle

would be subjected to torsion, besides which its efficiency would be greatly reduced when it had to work round the considerable curves due to increase of coiling. At the same time certain antero-lateral connections between the mantle and the body-wall became of increased importance. Muscular strands running from the shell through the mantle into the body-wall developed into pillars going from shell to foot. They held up the shell and visceral hump when the animal was extended, and served as pedal retractors. The shifting branchial cavity would need to accommodate itself to the right moiety of this muscular development, acquiring a position either to the left and in front of it, or to the right of and behind it. The former arrangement is the one that has actually come about, probably either because of the still considerable importance of external symmetry, or because of the inconvenient width assocciated with a lateral branchial cavity. At all events the branchial cavity became anterior, and was bounded on either side by a *shell-muscle*, as we may now call the pillar-like structures to right and left.

In the shift of the branchial cavity round the right side, from a postero-ventral to an antero-dorsal position, what was at first on the right became secondarily left, and what was primarily left acquired a position on the right. The important right ctenidium of the primitive Gastropods thus became shifted over to the left front, and most existing species possess this one only, its fellow having disappeared. An exception to this is, however, afforded by a few very primitive types, which have evolved on quite special lines, as primitive types and survivals so often do.

The muscular pillar on the left side of branchial cavity—in its new anterior position— would tend to obstruct the none too free entrance to that cavity, just at the place where the free entry of water to the important ctenidium was of prime necessity. And hence this muscle has disappeared from most Gastropods, except the *Fissurellidae*, Docoglossa, *Haliotis*, and *Scissurella*. The gradual diminution of the said muscle would involve the sagging of the hump on the left side, increasing the slight tilt in this direction already mentioned, so that the outer whorl would go back in an almost horizontal plane, instead of a nearly vertical one.

Meanwhile the habit of retraction became moreand more accentuated, and it was perfected by the substitution of a single shell-muscle taking origin fairly far back in the shell, as against a pair of muscles attached near its mouth. The evolution of the habit was also associated with a lengthening of the shell-cavity. This of course meant extra coiling, and if the coils remained pretty much in one plane the shell would acquire the form of a broad flat spiral, projecting in an inconvenient way on either side of the animal. It is, therefore, intelligible that variations in the direction of a conical spiral should have been selected, and why the shell of an average existing Gastropod should be of this shape. In it the centre of gravity is near the median plane, and as the morphological (pre-torsional) right side of the shell-cavity remains central throughout, the shell-muscle is attached as it were to

a central pillar, i.e. winds round the centre of gravity, and this effects the greatest economy of the strain necessary for the support of the weight of the shell and the visceral hump.

We thus at last reach the typical Gastropod with its operculum, conical spiral shell, twisted visceral hump, and antero-dorsal branchial cavity, and it is this type which has spread over the shore and down into the shallow seas. A number of primitive Gastropods, however, have managed to survive amidst less favourable surroundings by adapting themselves to special circumstances. *Haliotis*, for example, has gone back to the old habitat on the underside of boulders, and this has been associated with a flattening of the shell. and considerable reduction of its spiral, broadening of the right shell-muscle and the foot, modification of the branchial shell-slit into a series of holes, and so on.

The *Fissurellidæ* have also re-established themselves in a similar habitat, and in association with the clinging habit have re-acquired bilateral symmetry, especially as regards the shell-muscle and the well-known specializations of the branchial cavity and ctenidia.

Pleurotomaria has migrated into deep water, where perhaps many of the adaptations found in shallower water are also of value, though the environment is less favourable except as regards competition of other forms. Retraction also is of less importance.

In all these somewhat divergent types, and in the less known *Scissurella*, both ctenidia have been retained, but in *Haliotis*, *Scissurella*, and even *Pleurotomaria*, the left gill is larger than the right. Probably the environments of these forms are unfavourable to respiration, necessitating a maximum respiratory surface.

The Docoglossa have specialized in relation, first to a clinging, and then to an attached habit. In correlation with this, the paired shell-muscle has become a horse-shoe, well suited to pull down the shell so that its entire edge comes into contact with the subjacent rock-surface. At the same time the viscera have been compacted, and the shell has become a conical cap, with at most an apical trace of a median spiral.

It is possible that the *Bellerophontidae* may have been early but twisted Gastropods with a median spiral, or they may have been pre-torsional forms. The great broadening of the shell-mouth in some of them suggests a clinging habit, with its need for a complete cover for the animal.

Probably before the branchial cavity shifted forwards the efficiency of its flushing arrangements was increased by the development of a sinus in the median posterior part of the shell and mantle, which deepened into a slit corresponding to the opening of the anus. This slit has shifted forwards with the mantle cavity, and undergone well-known modifications in *Haliotis* and the *Fissurellidae*. The slit persits both in *Pleurotomaria* and *Scissurella*.

In forms possessing but one ctenidium, the incurrent stream on the side of the lost ctenidium has of course disappeared, and by movement of the more or less median anus and excretory apertures to the right, they have

been more completely removed from the proximity of the left ctenidium and its incurrent stream. With this shift of apertures to the right, a lengthening of the rectum, &c., has evolved *pari passu*, so that the anus, &c., tend to move forwards on the right side. In this improved arrangement the slit is no longer necessary and—as it must have always been a week point in the structure of the shell—has disapperred. It has also been lost in the Docoglossa, where a slit would undoubtedly militate against firm attachment, and its transfer in the Fissurellidae to the posterior part of the branchial cavity has not only minimised the reduction in the strength of the shell due to its presence, but also promoted efficient flushing in a special way. For it is just above the anus, so that the excurrent stream is as short as possible and does not take, as in *Haliotis*, &c., a direction contrary to the incurrent streams with resulting interference with the flow of both it and them. It may, however, be noted that in *Haliotis* a part of the excurrent stream makes its exit form each of the series of holes into which the slit is converted—just as it would do from the successive parts of a continuous slit—and the conversion of the slit into a number of holes also prevents the shell from being too much weakened.

In the foregoing article my aim has simply been to make a short preliminary statement of the results to which researches on the habits of Mollusca and the connected structural adaptations have led me.

I wish to gratefully acknowledge much kind help, and many valuable suggestions from my friend and colleague Dr. H. J. Fleure, who has been closely associated with me for some years in researches upon the structure and habits of Molluscs, especially of Gastropods, and in speculations on their phylogeny. Further articles, by one or both of us, will enter into a fuller discussion of the subject matter of this excursus, giving further details, and reviewing the relevant literature.

CURRENT LITERATURE.

Pilsbry, H. A.—Manual of Conchology, ser. ii, vol. xvii (pt. 68), pp. 209—232 xi-xviii, pls. 44—65. Philadelphia: Academy of Natural Sciences.

With the issue of part 68 Dr. Pilsbry completes another volume of this invaluable monograph, and commences the seventeenth volume which is to be devoted to the African *Achatinidae*.

In an interesting introduction he points out that these molluscs differ from the *Bulimulidae* by the long kidney, from the *Acavidae* by the diverse venation of the lung and the different dentition, and from the *Helicidae* chiefly by the narrow central tooth of the radula and the structure of the shell. So far no slug-like *Achatinidae* are known, but Dr. Pilsbry belives such to exist.

The African species are classified in three groups or sub-families, viz., *Achatininae*, *Stenogyrinae*, and *Coeliaxinae*.

The first sub-family comprises about a dozen genera. With three exceptions all the forms conform closely to a common type. Very brief particulars are then given of the generative and other organs in the different genera, together with a key based on shell characters. Of the anatomy of the second sub-family but little is known.

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SUPPLEMENT TO THE REVISION OF THE NEW ZEALAND POLYPLACOPHORA, WITH DESCRIPTIONS OF NEW SPECIES. (*)

BY HENRY SUTER.

(Plate ix.)

Callochiton empleurus, Hutton, sp.

Pl. ix, figs. 1—4.

Shell small, elongated oval, subcarinated, slopes very slightly convex, flesh-colour, with a squarish white patch on the posterior part of the jugal tract. Anterior valve (fig. 1) almost smooth, but minutely punctate; anterior margin with square white spots at irregular distances, and faint traces of radiate riblets. Posterior margin with a median notch. Intermediate valves (fig. 2). Central area minutely punctate, the jugum mostly smooth, with a few transverse shallow furrows; the pleural tracts with 9—10 deep pits on each side in front of the anterior edge of the lateral areas; these short pits become shorter and shallower towards the median part of the valve. Lateral areas raised, distinct, with well pronounced concentric ridges. Posterior valve (fig. 3) rather indistinctly minutely punctate, with a subcentral mucro, posterior slope slightly concave. Girdle (fig. 4) with characteristic minute, elongated and imbricating glossy scales. Colour of valves fleshy, lighter and with white streaks on the jugum. A white squarish spot on each intermediate valve on the posterior part of the jugum, and on the tail valve in front of the mucro. Interior pink, with the sutural laminae white. Sinus rather broad, shallow. Intermediate valves with 3 slits on each side.

Length 22, breadth 9 millim; divergence 83°.

Hab.—Near Stewart Island in about 15 fath.

Type in the Colonial Museum, Wellington.

A specimen was found on oysters dredged near Stewart Island by Mr. C. Cooper, of Auckland, who most kindly presented it to me. This specimen, partly rolled up, was used for giving some further information on this apparently rare species. As I did not want to disarticulate the only specimen, the number of slits in the terminal valves still remain unknown. The habitat of this species was hitherto unknown.

(*) Vide: Proc. Malac. Soc. Lond., 1897, vol. ii, p. 183.

Ischnochiton (s. str.) **fulvus,** n. sp.

Pl. ix, figs. 5—10.

Shell (fig. 5) small, elongated oval, with the sides subparallel, obtusely angled, slopes flatly convex, fulvous. In size, outline and colour very much like *Lepidopleurus inquinatus*, Reeve. Anterior valve (fig. 6) with a few concentric ridges, minutely quincuncially punctate; the anterior margin white, the remainder uniformly fulvous. There is a slight posterior median notch. Intermediate valves (fig 7). The whole surface minutely punctate like the anterior valve, with a few concentric ridges, which are more strongly developed on the lateral areas, The latter are distinctly separated from the central area by a broadly rounded edge, and there is no indication of radiate riblets. Posterior valve (figs. 8, 9) concentrically ridged and quincuncially punctate like the other valves; mucro subcentral, posterior slope slightly concave. Girdle (fig. 10) covered with very small imbricating scales of somewhat unequal size. Under the microscope they are seen to be flatly convex and deeply grooved, usually four grooves on a scale. The girdle is mostly concentrically banded with white and fulvous, two rows of scales to each band. Colour varies from light to dark fulvous, the dorsal and anterior areas being always lighter coloured. The anterior margin of the head valve, the anterior and lateral margins of the intermediate valves, and the entire margin of the tail valve have a narrow white border. Interior dirty white; sinus broad and deep, smooth. Anterior valve with 12 slits at unequal distances; intermediate valves with 1 slit on each side, posterior tooth small; posterior valve with 12 slits, the teeth unequal in breadth. All teeth are sharp and slightly grooved on the outer side.

Length 12, breadth 7 millim.; divergence 100°.

Hab.—Te Oneroa, Preservation Inlet and Brighton, Otago, South Island of New Zealand.

The only New Zealand *Chiton* which bears a close resemblance with this species is, as already pointed out, *L. inquinatus*, which however may at once be distinguished by the longitudinally striated intermediate valves. Dr. Torr informs me that this species also occurs in South Australian waters.

Plaxiphora glauca, Quoy and Gaimard, sp.

Chiton glaucus, Q. and G.: Voy. de l'Astrol., Zool., vol. iii, pag. 376. Pl. lxxiv, figs. 7—11 (1835).

I have specimens, found alive, from the Chatham Islands, collected and kindly sent to me by Mr. Fougére. They agree perfectly with Tasmanian specimens It seems rather curious that such a large shell should not have been recorded before.

Plaxiphora (s. str.) **murdochi,** n. sp.

Pl. ix, fig. 11.

Shell rather small, oval, slightly narrowed behind, roundly angled along the top of the valves, blackish-green, finely sculptured, intermediate valves mucronated, girdle rather narrow, of a minutely scaly appearance and with sparse hairlets. Anterior valve radiately eight ribbed, with five diverging striæ, which are coarser near the anterior margin, and from elongated nodules on the posterior edges. Intermediate valves with a lighter coloured posterior mucro, the whole surface sculptured with fine striae; the lateral areas are distinctly marked off by an elevated ridge descending from the jugum and dissolving into numerous fine striae near the margins, the striæ on the lateral areas and the pleural tracts are arranged in such a way that they radiate from the ridge like the webs from the shaft of a feather. The posterior margin has a row of nodules on each side, like the anterior valve. Central area with diverging riblets in front of the mucro, but straight and parallel to the jugum on the remaining surface. Posterior valve small, very slightly emarginate behind; mucro terminal, slightly raised, from the elevated postero-lateral ribs the fine riblets diverge straight in front, obliquely on the posterior side. Girdle has, viewed with an ordinary pocket lens, the appearance of being minutely scaly, but a more powerful lens reveals the fact that the whole girdle is densely and regularly pitted. Near some of the sutures I found tufts of a few light coloured bristles, and a few hairlets were found near the margin of the girdle, but it was not easy to find them. It seems most likely that the whole girdle was originally densely covered with fine, short hairlets and tufts near all the sutures, but that they are very easily rubbed off. Colour blackish-green, girdle a little darker. The anterior valve has a few concentric zigzag bands of light blue; the intermediate valves have a number of wavy, longitudinal blue streaks, running over the lateral and pleural tracts; the posterior valve has only an indistinct blue patch on each side. Interior blue, the sutural laminæ white. Sinus rather narrow, straight, the sutural laminae broadly arched, short. Anterior valve with 8 slits, corresponding to the external ribs, teeth strong, broadly grooved on the outside; intermediate valves with 1 slit on each side, corresponding with the ribs of the lateral areas; posterior valve with a smooth insertion plate with a posterior median sinus, no slits.

Length 17, breadth 13 millim.; divergence 108°.

Hab.—Near entrance to Kawhia Harbour, on rocks at half-tide. Much exposed to very heavy seas. (R. Murdoch).

Type in my collection.

With regard to the sculpture this species stands nearest to *P. biramosa* and *caelata*, but in both of these it is much coarser. The beautiful fine sculpture, colour, and the curiously pitted girdle, when devoid of hairs, separate it at once from the two.

I have great pleasure in associating with this species the name of its discoverer, Mr. R. Murdoch, of Wanganui, who also kindly supplied the drawing of the shell.

Acanthochites (Loboplax) rubiginosus, Hutton, sp.

Pl. ix, figs. 12—17.

Tonicia rubiginosa, Hutton: Trans. N. Zeal. Inst., 1872, vol. iv, p. 180. (*Chiton rubiginosus*, Swains., in coll.)

Chiton rubiginosus, Hutton: Journ. de Conch., 1878, vol. xxxvi, p. 39.

Tonicia rubiginosa, Hutton: Man. N. Zeal. Moll., 1880, p. 114.

,, ,, Pilsbry: Man. Conch. (1), 1893, vol. xv, p. 107.

Acanthochites (*Loboplax*) *costatus*, Suter: Proc. Malac. Soc. Lond., 1897, vol. ii, p. 194, non Adams and Angas.

Acanthochites rubiginosus, Hutton: Index Faunae Novae Zealandiae, 1904, p. 86.

Shell (fig. 12) oblong, small, subcarinate, the whole surface granular, mostly yellowish-pink, girdle with minute spines and sutural tufts. Anterior valve (fig. 13) with five ribs which are not very conspicuous, the whole surface granulated, the granules being largest, and sometimes unequal in shape, near the margin, and decreasing in size towards the apex of the valve, which is slightly sinuated. Intermediate valves (fig. 14) with the jugum sparsely longitudinally substriated; the pleural tracts are granular; the lateral areas, but slightly raised and not very clearly separated from the pleural tracts, are similarly sculptured, the granules being again largest near the margin, round or oval in shape. The valves are subcarinate, beaked posteriorly. Posterior valve (figs. 15, 16) small, the mucro central, with a smooth triangular area in front, beyond which the whole surface is granular, the granules being comparatively large. Posterior slope concave, no signs of radiating ribs. Girdle (fig. 17) thick, fleshy, beset with microscopic white spicules; there are sutural tufts of white spicules, 7 on each side, and 4 tufts in front of the head valve. Colour.—This is, as I pointed out in my former paper, variable, adult specimens showing mostly a pinkish colour, yellowish on the back, but young shells sometimes have a most beautiful colour arrangement, the granules being white, pink, light brown and light blue. The jugal tract is in the intermediate and tail valves of a darker colour, mostly reddish-brown and assuming a triangular shape. The girdle is light fulvous with small patches and radiate bands of whitish-yellow. Interior white, but the centre of the valves, head valve excepted, is pink coloured; the sinus is rather narrow and deep. The anterior valve with 5 slits, corresponding with the ribs; intermediate valves with 1 slit on each side, strong teeth, and a stout valve-callous; posterior valve with a low, thick insertion plate and 4 short slits.

The figured specimen has: Length 17, breadth 13 millim.; divergence 103°.

Hab.—Cook Straits, Foveaux Straits, in the latter locality in about 15 fath.

Type in the Colonial Museum, Wellington.

At the end of 1898 Dr. Pilsbry very kindly brought the fact under my notice that my *A. costatus* was not the same as the Australian shell, and that it had to be called *A. rubiginosus*, Hutton. Being unable to procure a specimen of *A. costatus*, Mr. Etheridge, jun., Curator of the Australian Museum, Sydney, informing me that only two specimens had ever been found, and that it was unknown to Australian collectors, I now proceed to point out the difference of the two species from Smith's diagnosis in Man. Conch.—: *A. costatus* is more elongated and narrower than *A. rubiginosus*, the respective ratios being 1 : 2, 6 and 1 : 1, 3. *A. costatus* has the lateral areas well defined by a raised keel, which is absent in *rubiginosus*. The posterior valve of *costatus* has six radiating ridges and the insertion plate with 6 notches, against no ridges and and 4 slits in *rubiginosa*. The colour of *costatus* is pale brown, whilst *rubiginosus* is sometimes beautifully coloured, producing quite a kaleidoscopic aspect, as Dr. Torr correctly expressed himself when I lately showed him some specimens in my collection.

Chiton quoyi, Desh., n. sub-sp. **limosa.**

Chiton aereus, Suter: Proc. Malac. Soc. Lond., 1897, vol. ii, p. 195, non Reeve.

When I wrote the Revision of the New Zealand Polyplacophora in 1897 I had not seen the true *C. aereus*, Reeve, which seems to be a very rare species. I sent a specimen of my supposed *aereus* to Dr. Pilsbry in 1898, and he told me that it was only a slight form of *C. quoyi*, not specifically distinct, and not the true *aereus*. I also sent specimens to Mr. E. R. Sykes, of London, asking him to kindly compare it with the type specimen in the British Museum. With his usual obliging readiness he sent me the following information: "If the specimen, presumably type, in the Brit. Mus. can be trusted, your Chitons are not, I think, *aereus*: the sculpture on that species is *much* stronger and coarser on the median areas, i.e. more like that of *canaliculatus*. The Museum *aereus* is larger—nearly twice the size—and of an olivaceous green." A few years later I received some specimens of a *Chiton* from Mr. Murdoch, Wanganui, which he had found near Cape Egmont, and these proved to be the true *C. aereus*, Reeve. It is indeed very different from my supposed *aereus*, which I now class as a sub-species of *C. quoyi*, Desh. It differs from the species in being smaller and narrower, the jugum angled, not carinated, not always smooth, colour yellowish to green, mostly coated with blackish-green. Anterior valve with 8, posterior valve with 15 slits, divergence about 100°, against 120° in the species.

Length 20, breadth 12 millim.

Hab.—Under stones on mud-flats in Manukan and Auckland Harbours.

Type in my collection.

Chiton aereus, Reeve.

This species belongs to what I will call the *canaliculatus* group, having a coarse sculpture and the central area with strong longitudinal ribs and grooves. Also *C. stangai*, Reeve and *C. limans*, Sykes, are to be included in this group. *C. aereus* may at once be separated from the others by the longitudinal furrows of the pleural tracts being rubbed off in the middle, not unlike those in *Callochiton empleurus*, where however they are much shorter.

In my specimens the surface of the valves is microscopically shagreened, the girdle has mostly a few radiate white bands on the sides, and the scales are faintly striate. There occurs a red variety, sometimes yellowish-red, as in a specimen found by Miss Mestayer at Lyall Bay, or bright cinnabar red, as in a specimen I found in Hauraki Gulf. This latter specimen is also banded with white on the girdle, and the lateral areas of valves 3—5 are clouded with light black.

Hab.—Cape Egmont, west coast of North Island (R. Murdoch); Lyall Bay (Miss Mestayer); Hauraki Gulf (H. S.).

Chiton huttoni, Suter.

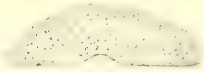
This species will be described and figured in Trans. N. Zeal. Inst., vol. xxxviii, to be published in 1906. This species also belongs to the *canaliculatus* group, its usual colour is yellowish-olive, but a brick-red variety is also met with.

Acanthopleura (Maugeria) granulata, Gmelin, sp.

Chiton granulatus, Gmelin: Syst. Nat., 1790, vol. iii, pl. 16, p. 3205.
Acanthopleura (Maugeria) granulata, Pilsbry: Man. Conch. (1), 1893, vol. xiv, p. 227, pl. lx.
,, ,, *corticata*, Suter: Proc. Malac. Soc. Lond., 1897, vol. ii, p. 198, figs. 12—17 in text.

At the request of Dr. Pilsbry I sent him the valves and denuded girdle of *A. corticata*, Hutton, for examination, and I was greatly astonished on receiving from him the following information:—"*A. corticata*, Hutton, is merely a specimen of *A. granulatus*, Gmelin, of the West Indies. That species varies a good deal, and we have valves exactly like yours. By using the key on page 217 of Manual you would have brought your specimen to that species." That is quite true, but even if I had found it to be *A. granulata* I would certainly have doubted the correctness of my identification, for who would look for a West Indian Chiton in New Zealand? However, Dr. Pilsbry is right. There is now a fine, perfect spëcimen in the Colonial Museum, Wellington, which perfectly corresponds with specimens from the West Indies kindly presented to me by Dr. Pilsbry.

Another mollusc we share with the West Indies is *Pecton medius*, Lamk., of which our *P. laticostatus*, according to Hedley, is a synonym.



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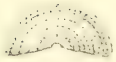

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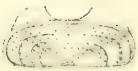

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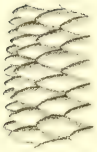

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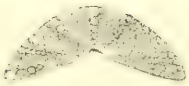

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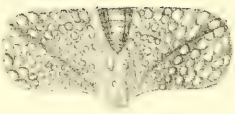

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12.

15.

17.

H.S. del ad nat. F.g.ll, R.M. del ad nat. Huth, Lith^r London

NEW SPECIES OF POLYPLACOPHORA.

Onithochiton semiseulptus, Pilsbry.

Man. Conch., (1) 1893, vol. xiv, p. 247, pl. lv, figs. 10—11.

Some years back Mr. H. B. Kirk (now professor of biology) after his return from the Chatham Islands showed me two Chitons belonging to the genus *Onithochiton*, and I was sure I had not seen the species before Mr. Kirk very kindly presented them to me, and I found that they represented the above species, whose habitat was unknown to Dr. Pilsbry. I sent him one specimen for comparison with the type, and I was kindly informed that my determination was correct.

One specimen is now in the Canterbury Museum, Christchurch, the other in my collection.

EXPLANATION OF PLATE IX.

Figs. 1—3.	*Callochiton empleurus*, Hutton.	Valves enlarged.
Fig. 4.	„ „ „	Girdle scales. × 60,
„ 5.	*Ischnochiton fulvus*, Suter.	Shell nat. size.
Figs. 6—9.	„ „ „	Valves enlarged.
Fig. 10.	„ „ „	Girdle scales, × 60.
„ 11.	*Plaxiphora murdochi*, Suter.	Shell enlarged. R. Murdoch del.
„ 12.	*Acanthochites rubiginosus*, Hutton.	Shell nat. size.
Figs. 13—16.	„ „ „	Valves enlarged.
Fig 17.	„ „ „	Part of girdle, magnified.

A FEW NOTES FROM THE ANTIPODES.

By HENRY SUTER.

(1.) It is not very long since I acquired Bruno Beutler's "Die Anatomie von *Paryphanta hochstetteri*, Pfr.," shortly reviewed in this Journal (vol viii, 1901, p. 125). Though over five years have passed since its publication, yet I beg to be allowed to make a few remarks which may prove of general interest.

The author mentions that Prof. Spengel helped him considerably to procure the necessary literature, but on examining the long list, four pages, we find that no mention is made of Lieut.-Colonel Godwin-Austen's paper on the anatomy of *Paryphanta hochstetteri* (Proc. Mal. Soc., vol. i, page 5), though it was published as far back as 1893, whilst Beutler's paper was issued the 24 April, 1901! Such an omission is hardly excusable; does the University of Giessen not keep the "Zoological Record"? There is also no mention made of Mr. Walter E. Collinge's paper "On the Anatomy of certain Agnathous Pulmonate Mollusks" (Ann. Mag. Nat. Hist. (7), vol. viii.) which appeared in January, 1901, nor of my short papers puplished in 1899. Like Godwin-Austen, Beutler seems to have overlooked the interesting fact, demonstrated by Collinge, that the vas deferens, joining the penis very low down, continues, hidden by tissue, to the distal end. However, there arises the question whether this peculiarity is a constant feature, as Beutler gives a figure of a cross-section of the penis (fig. 49) which does not show the vas deferens, but it is not stated from which part this section was obtained.

The formula of the teeth of the odontophore was found by Godwin-Austen to be 67—1—67, by Beutler 59—1—59. the difference being perhaps due to different ages of the animals examined. The high papillae on the interior wall of the penis, recorded by Beutler, seem to have escaped Godwin-Austin's notice.

The specimens examined by Beutler belonged to the dark brown variety of *P. hochstetteri*, as it occurs in the Takaka Valley and in the Manawatu district, and it seems to have been overlooked by many systematists that he bestowed the name *obscura* on this variety.

(2) When dealing with "Clessin's new Species of *Scalaria* from New Zealand" in this Journal, 1899 (vol. vii, pag. 54), I stated that *S. zelebori* was first described by Frauenfield in "Reise der Novara, Zool., 1868." This however is not correct, as I found out lately after the acquisition of a reprint of "Bericht über die von der Novara—Expedition mitgebrachten Mollusken, von Dr. Dunker and Joh. Zelebor," which appeared in "Verhandl. Zool. Bot. Gesell. Wien, 1866, vol. xvi" There, on page 912, is to be found the diagnosis of *Scalaria zelebori*, Dunker. The latter is therefore the real author of the species, and the date of publication 1866. Why Frauenfield put *his* name after the species in the Novara work I cannot tell.

(3) The generic position of some of the New Zealand species of the family *Pleurotomidae*, as suggested by myself, has never appeared to me to be quite satisfactory, but the want of literature did not allow me to attempt a better classification. Mislead by remarks in "Harris' Cat. Tert. Moll. Australasia" on *Pleurotoma wanganuiensis* and *P. buchanani*, Hutton, I classed about half a dozen species under *Surcula*. Fortunately the splendid "Essais de Paléoconchologie Comparée par M. Cossmann" are now in my possession, thanks to the great liberality of the author, and lately I have made an attempt to classify the species represented in my collection (marked with an an asterisk in the list). Being of general interest, I venture to publish here a synopsis.

FAM. PLEUROTOMIDAE.

SUBF. PLEUROTOMINAE.

Pleurotoma ischna, Watson, 1881.
* Drillia novae-zelandiae, Reeve, 1843.
* ,, trailli, Hutton, 1873.
* ,, buchanani, Hutt., subsp. maorum E. A. Smith, 1877.
,, amoena, E. A. Smith, 1884.
* ,, verrucosa, Suter, 1900.
* ,, (Crassispira) laevis, Hutton, 1873.
* ,, (Cymatosyrinx) lyallensis, Murdoch, 1905.
Spirotropis bulbacea, Watson, 1881.

SUBF. CLAVATULINAE.

Surcula gypsata, Watson, 1881.

SUBF. BORSONINAE.

* Mitromorpha subabnormis, Suter, 1900.
* ,, substirata, Suter, 1900.
* ,, suteri, Murdoch, 1905.
* Bathytoma albula, Hutton, 1873.
* ,, zealandica, E. A. Smith, 1877 (= cheesemani, Hutton, 1878).

SUBF. MANGILIINAE.

Mangilia ula, Watson, 1881.
* ,, sinclairi, E. A. Smith, 1884.
,, goodingi, E. A. Smith, 1884.
* ,, dictyota, Hutton. 1885.
* Mangilia, subanstialis, Suter, 1900.
* ,, flexicostata Suter, 1900.
* ,, (Clathurella) nodicincta, Suter, 1900.
* ,, ,, epentroma, Murdoch, 1905.
,, ,, ,, subsp. whangaroensis, Murdoch, 1905.
* Daphnella cancellata, Hutton (=lymnirfornsis, Hutton, non Kiener).
,, membranacea, Watson, 1886.
,, xanthias, Watson, 1886.
,, protensa, Hutton, 1885.

ON THE HABITAT AND FOOD OF HELIX DESERTORUM.

By the Rev. A. H. COOKE, M.A.,
Head Master of Aldenham School.

Two recent visits to Egypt, in the winter of 1903 and 1904, enabled me to examine carefully the conditions under which this species lives, and which suggested certain interesting problems

Helix desertorum is abundant in the neighbourhood of the Pyramids of Ghizeh. It does not appear to inhabit the cultivated district at all. The ground on which the Pyramids stand is sheer desert, loose sand, stones, and bare rock. At first sight, not a single living plant appears, but careful search will reveal, here and there, a few dry stubly wisps. Near to them, a few *desertorum* may be found, but the great mass of living specimens are at least 500 or 600 yards away, on a plateau which appears utterly destitute of vegetable life. Here the species abounds ; the young live gregarious under stones, which shield them from the burning rays of the sun, while the adults occur, for the most part, singly in the open, some attached to rock, the majority scattered about on the open face of the smooth sand. I may remark parenthetically that, at the time of my visits, which were in the months when rain occasionally falls, the food conditions were presumably at their optimum, and not an atom of food was to be seen. There was no appearance of "aestivation" or "hibernation" : the adults were as fat as butter, and evidently in prime condition.

The problem naturally suggested itself, What do the creatures feed on? Cannibalistic tendencies are out of the question, for the radula is of the normal type represented by *H. aspersa*. It occured to me that an examination of the excreta might supply some answer to the question, and accordingly I collected a number of specimens, carefully brushing away all traces of sand from the region of the mouth, and, on returning home, handed a selection from their excreta to my senior science-master, Mr. J. M. Wadmore, M.A., F.C.S., for analysis. He reports as follows :—

"I have much pleasure in giving you the result of my examination of the Egyptian snails' excreta.

"Broadly speaking, the material consisted of two portions. (1) Sand, forming about half the total weight ; (2) a fluffy, fibrous substance. The latter was extracted with warm dilute hydrochloric acid, in which a small portion dissolved, but the greater part remained unaffected.

"The solution thus obtained was coloured with organic matter, the nature of which I was unable to ascertain. I succeeded, however, in establishing the presence of iron and calcium, both in relatively considerable quantity. Potassium I was unable to detect, even by means of the spectroscope, and though I should not like to say definitely that this metal is absent, I feel sure, at any rate, that the amount must be excessively small.

"In the portion undissolved by the acid, I found unmistakable indica-

tions of carbon, in considerable quantity; also nitrogen, though in smaller amount, and, in all probability, hydrogen. Doubtless these elements were originally united to form complex organic substance.

"Conjectures as to the sources from which the snails obtained these elements must necessarily be vague and uncertain; from some sort of plant, I should fancy. The presence of carbon and hydrogen, also the traces of the metals iron and calcium, all point to this; but it must be of unusual nature, otherwise potassium ought to occur in recognisable quantity."

It is natural to conjecture that the snail feeds on some minute form of lichen, which it rasps off the surface of the stones. No lichen, however, is visible, and one would naturally expect, even if so low a form of vegetable life as lichen were the staple of food, to find considerable traces of potassium. In reference to this, Mr. A. W. Hill, Lecturer in Botany at the University of Cambridge, writes to me: "There is no doubt that small lichens contain potassium salts like all other plants. But I am not sure whether any direct analysis has been made. I have talked to our physiological botanists, and they agree with the above remarks."

My friend, Mr C. T. Heycock, F.R.S., suggests the possibility that some small alga like *Nostoc* may be the food. "*Nostoc* seems to be present in very arid places; it is invisible by day, but swells into a jelly-like mass when moist, say, with morning dew."

I am inclined to think that the true solution of the problem lies in the direction suggested by Mr. Heycock. Whether any chemical analysis has as yet been made of this class of alga I am unable to say, but if such analysis were to show that potassium did not occur, or occurred only in excessively small quantities, in this alga, some advance would have been made. One or two points at least are clear. The snail obviously swallows sand in large quantities. Some of the grains evacuated approach a millimetre in length and breadth. Its food, therefore, would seem to occur, not on the rocks or stones, but amongst the sand itself, and this will account for the fact that so many specimens are found on the sand. Evidently, too, the food must be of a nature so minute as to make it impossible to swallow it without swallowing the sand at the same time. Thus the method of nutrition in *Helix desertorum* will appear to be somewhat analagous to that of the ordinary bivalve mollusc, which nourishes itself on the minute organisms present in the water which passes through its system.

I may add that I have sent a good series of *H. desertorum* to the British Museum, and also suggested to Mr. E. A. Smith that he might like to try over again the well-known experiment on the creature's vitality. He kindly consented, and I sent him half-a-dozen good living specimens, which have, under his care, started in an attempt to "beat the record" of the celebrated snail of 1850, which was discovered to be alive after it had been fixed to a tablet for four years (Ann. Mag. Nat. Hist., 1850 (s. 2), vol. vi, p. 68.)

ON THE ANATOMY OF ENSIS (SOLEN) MAGNUS, SCHUMACHER.

By H. H. BLOOMER.

By the kindness of Dr. Jensen of the Copenhagen Museum I have been enabled to examine a specimen of *E. magnus*.

Ensis magnus is an elongated animal, measuring in length about six times the measurement from the dor al to the ventral surface at its deepest part. It is larger and more massively built than *E. ensis*. It curves a little dorsally (not quite so much as *E ensis*), is bilaterally symmetrical, and is enclosed ventrally by the concrescence of the edges of the mantle lobes, with the exception of the apertures at the anterior and posterior ends, and a fourth aperture situated nearly at the centre of the ventral surface (the aperture is nearer the posterior than the anterior end, while in *E. ensis* it lies nearer the posterior end).

The periostracum passes from the outside of the shell to the edges of the mantle lobes, to which it adheres.

The pallial muscles form a deep band along the margin of the mantle lobes, and, at the anterior end, encircle the pedal aperture through which the foot is protruded. At the posterior end the muscles assume a more elliptical condition, being more coalesced both dorsally and ventrally, and form the siphon containing the afferent and efferent chambers. The ventral portion of the proximal portion of the siphon extends more posteriorly than in *E. ensis*.

The foot projects from nearly the centre of the ventral surface of the animal, and proceeds in an anterior direction. A little anterior to the foot is the mouth, and in front of the mouth, is the very broad anterior adductor muscle. On each side of the viscero-pedal mass are the labial palps, commencing between, and passing posteriorly to them, are the two gills, which continue as far as the siphon. The inner sides of the bases of the gills are joined together from the foot for about half their distance, whereas in *E. ensis* they are not so connected.

The anus opens from the free portion of the rectum, into the cloacal chamber behind the posterior adductor muscle.

The siphon consists of two separate chambers, the upper one the exhalent, and the lower one the inhalent. The free portions of the siphonal chambers are very short and separate from each other. Both are encircled with a fringe of tentacles (the tentacles are not so long as in *E. ensis*).

The fourth aperture is an elliptical opening which narrows very much

on the inside edge of the mantle lobes. Around the inside of it, but near the outer edge, is a row of tentacles; those on one side alternating with those on the opposite side (the tentacles are not so long as in *E. ensis*.)

On the inside of each mantle lobe is a groove passing dorsally from this aperture towards the foot, and in it lie the distal portions of the labial palps.

The anterior adductor muscle is an extremely broad and shallow muscle, deepening as it proceeds posteriorly. It is connected anteriorly with the mantle lobes and dorsal integument, and posteriorly with the dorsal and ventral integuments.

The posterior adductor muscle is a comparatively small muscle, curved ventrally and flattened dorsally. It is joined anteriorly with the bifurcations of the retractor pedis posterior muscle, and posteriorly with the dorsal integument.

The retractor pedis anterior muscles, as in *E. ensis*, have long bifurcations, the posterior ones passing through the liver to the valves of the shell, and the anterior ones going some distance over the anterior adductor muscle before adhering to the shell.

The retractor pedis posterior muscle is a thick muscle of medium length, the bifurcations of it, which are attached to the shell, rest against and are connected with the posterior adductor muscle.

Owing to the imperfect preservation of the inside of the animal it is not possible to make out the internal structure in detail, but it appeared to be very similar to *E. ensis*.

The gills are of the type heterorhabdic and are also plicate, but the plication is shallower than in *E. ensis*, while the interlamellar junctions are longer. The number of filaments in a plica range between 13—17.

ON THE ANATOMY OF CERTAIN SPECIES OF SOLENIDAE.

By H. H. BLOOMER.

(Plate x.)

I am indebted to the late Professor E. von. Martens of the Berlin Museum, for the privilege of examining the specimens now described which he so kindly placed at my disposal. When sending them he gave the following particulars :—

"2. *Solecurtus dombeyi*, Lam. Peru, from Professor Dunker's collection.

2. *Solen corneus*, Lam. Indian sea, from the collection of Lamare Piegnot made about 1836.

1. *Solen gouldi*, Conr. Yeddo = Tokio, Japan, collected by Professor Hilgendorf in 1873—76.

2. *Cultellus javanicus*, Lam. Singapore, collected by myself in 1860—62.

2. *Solen delerscoti*, Chemn. (= *brevissimus*, Marts., 1865), Singapore, collected by myself at the same time.

1. *Solen (Solena) rudis*, C. B. Adams, Panama, very near to *S. ambiguus*, Lam. from the West Indies."

Solecurtus dombeyi, Lam.

Pl. x, figs. 1—3.

External characters.—The animal curves outwardly along the dorsal surface. The length from the anterior side of the anterior adductor muscle to the posterior side of the posterior adductor muscle is 51 millim. and the depth 19.

The mantle lobes are joined together at the anterior side of the anterior adductor muscle. Then, separately, they pass with a curve around the anterior end, and proceed posteriorly until they reach a position a little anterior to the proximal portion of the siphon, where they become concresced, consequently, the pedal aperture occupies the anterior and nearly the whole of the ventral surface. Laterally, and some distance anteriorly to the posterior edge, the mantle lobes are connected on their inner sides with the proximal portion of the siphon, which enables them to contain the free portions of the siphon when contracted, and the greater portion of them when extended (fig. 1. *P.L.P.*)

In the specimens examined the free portions of the siphon are nearly enclosed, the exhalent (fig. 1. *Ex. S.*) portion being contracted, and folded on itself, and the inhalent one (fig, 1. *In. S.*) partly inverted, so that the

whole of it is withdrawn into the pallia chamber. The proximal portion of the siphon is short, but of greater depth than that of *Tagelus rufus*, while the free portions, though long and muscular, are shorter and thicker than those of the same species Internally they show both longitudinal and fine transverse ribbing, but externally only the transverse ribbing.

There are large siphonal retractor muscles. The foot (fig. 1. *F.*) is massive and of medium length, being longer and of a more uniform depth than in *T. rufus.*

The gills reach to the proximal portion of the siphon. The inner sides of their bases are joined together, and divide the exhalent from the inhalent chamber. The teeth of the shell are buried in the viscera about the centre of the dorsal surface.

Musculature.—The musculus cruciformis (fig. 1, *M.C.*) is present at the extreme ventral edge of the siphon, but it is not so pronounced as in *T. rufus.*

i. *Pallial muscles.*—The muscles of the pallial edge commence at the anterior adductor muscle as a deep band, and gradually decrease in depth as they proceed posteriorly. The muscles of the siphon are strongly developed, and the siphonal retractor muscles, where they adhere to the valves of the shell, present a large surface.

The anterior adductor muscle (fig. 1, *A.A.*) is a broad, comparatively long, but shallow muscle, flattened dorsally, and curved ventrally. As in *T. rufus* it is divided by the ventral integument passing through it. The muscle is connected anteriorly with the mantle lobes, and posteriorly with the dorsal and ventral integuments.

The posterior adductor muscle (fig. 1, *P.A.*) is more oval in shape than that of *T. rufus,* and is joined anteriorly by connective tissue with the bifurcations of the pedis retractor posterior muscle and dorsal integument, and posteriorly with the dorsal integument, the siphon, and the mantle lobes.

Just below the siphon there are two transverse muscular bands—the musculus cruciformis of Von Ihering (fig. 1, *M.C.*), which quickly converge and unite at the centre, the four distal ends after passing through the mantle lobes, are attached to the valves of the shell, thereby resembling the same muscle found in *Solecurtus strigillatus*, but more particularly that in *T. rufus*, though on a very much smaller scale that the former, and in not having the posterior portion shortened as in the latter.

ii. *Pedal Muscles*—The muscles of the foot are strongly developed, and structurally approximate nearer to those of *Pharella (Cultellus) orientalis* than those of *T. rufus.*

The pedis retractor anterior muscles run ventrally inside the longitudinal muscles (that is, they are exposed when viewed from the pedal cavity). The free portions are thick and short, and pass dorsally to the shell. There are no bifurcations.

The pedis retractor posterior muscle (fig. 1, *P.R.P.*) is also short and thick. The bifurcations are short too, and rest on the antero-dorsal surface of the posterior adductor, where they are connected with the valves of the shell.

There appears to be some indication of the presence of the branchial retractor muscles as noticed in *S. strigillatus*, but in the specimens examined they are so indistinct that it is impossible to state definitely whether they exist or not.

Alimentary Canal.—The lips (figs. 2 and 3, *A.L.* and *P.L.*) are broad and not very long. The oesophagus (figs 2 and 3, *Oe*) is short and soon opens into the oesophageal division of the stomach (figs. 2 and 3, *Oe. St.*). The latter is large and of irregular shape. Posteriorly it is separated from the cardiac (fig. 2, *C. St.*) and central (fig. 2, *C.D.*) divisions by a slight muscular ridge. On examining the left side of the stomach (fig. 2) it will be observed that the cardiac division, which is small, lies between the oesophageal and pyloric (figs. 2, *P.St.*) divisions, and antero-dorsally to the central division. Further the central division is bordered dorsally by a more muscular ridge (fig. 2, *M.P.*), the homologue of the muscular papilla of *Solen*. On the right side of the stomach (fig. 3) the demarcation of the cardiac division is incomplete. The pyloric division (figs. 2 and 3, *P. St.*) is large, and posteriorly proceeds as the caecum of the crystalline style (figs. 2 and 3, *C.C.*) The latter is also large, and, gradually curving, traverses anteriorly some distance along the pedal cavity.

The intestine (fig. 3, *In.*), as in *S. strigillatus* and *T. rufus*, appears as a groove on the right anterior side of the caecum of the crystalline style, but as far as can be made out, the projection of the muscular layer between the two cavities is greater, and consequently reducing the channel of communication. At the distal end of the caecum the intestine becomes distinct and returns a part of the way along the dorsal surface. Leaving the caecum, it pursues a loose folded course to the dorsal surface of the pyloric division, then, turning posteriorly, continues as the rectum (fig. 1, *R.*) over the posterior adductor muscle to the exhalent siphonal chamber.

The liver (fig. 1, *L.*) lies laterally and ventrally to the stomach, but by far the greater part is underneath it.

Nervous system—The nervous system seems to closely resemble that of *S. strigillatus*.

The Gills.—As in the species of *Solecurtus* examined by Dr. Ridewood, the lamellae are highly plicate, resembling more particularly those of *Solenocurtus (Tagelus) rufus*, in the interlamellar septa rising high up the demibranch, and in possessing a blood vessel at the apex of the plica. The number of filaments in a plica are, however, less. It is not possible to make out the structure in further detail as the gills are not well preserved.

Solen corneus, Lam.

Pl. x, fig. 4.

When compared with *S. vagina* shows the following differences :— The animal is not so muscular. The ventral part of the mantle lobes at the anterior end projects more anteriorly than the dorsal part (fig. 4, *M.L.*), whereas, in *S. vagina* they are not as angular The anterior adductor muscle is proportionately not so wide, the distal portion of the foot is still shorter, and the posterior adductor muscle is much narrower, while the part of the animal posterior to the posterior adductor muscle is considerably longer. The internal structure apparently is the same.

Solen gouldi, Conr.

Pl. x. fig. 5.

Only one specimen of the above in the collection, which unfortunately had been pressed out of shape, and is in a very bad state of preservation.

It appears to be very similar to *S. vagina*, only differing from it in the anterior projection of the ventral portion of the anterior part of the mantle lobes (fig. 5, *M. L.*), more so than in *S. corneus*, Lam.

Cultellus javanicus. Lam.

Pl. x, fig. 6.

There are two specimens of the above in the collection, but, owing to their imperfect preservation, it is impossible to make out with any degree of certainty a great deal of the internal structure, particularly the alimentary canal.

The animal is slightly curved outwardly along the dorsal surface, and inwardly along the ventral surface, the centre of the latter being a little compressed. The anterior and posterior parts are tapered, and the ends rounded.

The mantle lobes are concresced along the whole of their ventral surface, so that the pedal aperture is confined altogether to the anterior end, and there is no fourth aperture. The muscles of the pallial edge form only a shallow band, and are not strongly developed. At the posterior end is the siphon, which likewise is not very muscular. In its proximal part the exhalent (fig. 6, *Ex. S.*) is separated from the inhalent chamber (fig. 6, *In. S.*) by a muscular wall, having its anterior side joined to the gills. The free portions of the siphon are very short, and encircled by a tentacular fringe.

The foot (fig. 6, *F.*), which at the distal end is axe-shaped, is long and of a nearly uniform depth.

The inside edges of the bases of the gills are joined together, while the outside edges have become disconnected with the pallial wall, as so frequently happens in the case of *S. vagina.*

One of the chief characteristics is the proportionately greater length of the posterior part of the animal.

The anterior adductor muscle (fig. 6, *A.A.*) is a somewhat oval shaped muscle, flattened dorsally, connected anteriorly with the mantle lobes, and posteriorly with the dorsal integument, and by connective tissue with the proximal portion of the foot.

The posterior adductor muscle (fig. 6, *P.A.*) is a comparatively wide and shallow muscle, connected anteriorly with the dorsal integument and the pedis posterior retractor muscle, and posteriorly with the dorsal integument and the siphon.

The retractor pedis anterior muscle, which is connected with the shell, is very short and not bifurcated, while the retractor pedis posterior muscle (fig. 6, *P.A.*) is very long, with long bifurcations, which are joined to the posterior adductor muscle and the valves of the shell.

As far as can be made out the alimentary canal has the appearance of consisting of a short oesophagus, large stomach with the usual divisions, and the caecum of the crystalline style and the first portion of the intestine either possessing separate passages with the outside of the organs joined together, or communicating with each other as in *S. strigillatus* and *dombeyi*.

Solen delerscoti, Chemn.

S. delerscoti is very short, the length being not more than three and a half times the depth, and, judging from the specimens examined, a much smaller animal than *S. vagina*—though it has the appearance of being comparatively largely built, with a large foot and siphon. It very closely resembles *S. vagina*, differing from it in the shortness of the anterior part, particularly the anterior adductor muscle, and the greater length of the posterior part, more especially the proximal portion of the siphon. The specimens are not in a good state of presevation, but as far as can be seen of the alimentary canal, the only noticeable point is that the cæcum of the crystalline style does not extend as far anteriorly along the pedal cavity.

Solen (Solena) rudis, C. B. Adams.

Pl. x, figs. 7—9.

External characters.—The specimen was removed from the shell before being sent to me. The animal measures 7 c.m. from the anterior end of the mantle lobes to the posterior end of the posterior adductor muscle, and 21 millim. from the dorsal to the ventral surface It is nearly of a uniform depth.

The mantle lobes are concresced along their ventral surface. The pedal aperture is situated at the anterior end and does not extend posteriorly, either dorsally or ventrally. The periostracum is only attached to the mantle lobes bordering the pedal aperture. Inside the lobes are two muscular flaps, which close the pedal aperture when necessary. There is no fourth aperture.

At the posterior end the mantle lobes form the proximal portion of the

siphon (fig. 7, *In. S & Ex. S.*). The latter is of considerable length and very muscular. Nearly the whole of the free portion is missing, so it is not possible to form any idea as to its length, or to say, if the exhalent portion is separate from the inhalent one as in *S. strigillatus* (fig. 7, *Ex. S.* and *In. S.*).

The labial palps are relatively short and wide. The gills pass posteriorly from the labial palps to the posterior end of the proximal portion of the siphon, and, on the outside of them, the bases are connected with the lateral siphonal ridges (fig. 7, *S R.*), while on the inside they are joined together as in *S. strigillatus.*

A strong muscular dorsal integument is present resembling that of *Solen* and *Ensis.*

The kidneys extend slightly literally along the mantle lobes as in *S. strigillatus.*

The foot (fig. 1, *F.*) is long and of nearly uniform depth. It, however, gradually increases in width towards the distal end, near which it is almost round, but suddenly tapers off at the extremity.

i. Pallial muscles.—The muscles of the mantle lobes form a deep band of muscles lying at right angles to the pallial edge, and are further strengthened by a band of longitudinal muscles along the concresced ventral part. The proximal portion of the siphon (fig. 7, *Ex. S.* and *In. S.*) is long, the arrangement of the muscles being similar to that of *S. strigillatus*, viz., large longitudinal muscles, covered internally by a muscular lining, and externally by the muscular integument.

Anteriorly the longitudinal muscles converge to form the siphonal retractor muscles, but they do not present nearly so large a surface where they adhere to the shell as in *S. strigiliatus.* Between the proximal portion of the siphon and that representing the free portion are two muscular flaps or valves. This applies to the exhalent as well as to the inhalent chamber.

The anterior adductor muscle (fig 7, *A.A*) is a broad and deep muscle, flattened dorsally, and curved ventrally. It is joined anteriorly with the dorsal integument and mantle lobes, and posteriorly with the ventral integument. The posterior adductor muscle (fig. 7, *P.A*) is similar to the anterior adductor muscle, but is not so deep. It is joined anteriorly with the retractor pedis posterior muscle and the dorsal integument, and posteriorly with the siphon, the mantle lobes, and the dorsal integument

ii. Pedal muscles.—The longitudinal muscles of the foot are strongly developed and interspersed with a great number of transverse ones, the latter, however, are not so numerous as in *S. strigillatus*, but more so than in *Solen.*

The free portions of the retractor pedis anterior muscles (fig. 7, *P.R.A.*) are short and large When the muscle reaches the foot it spreads out ventrally, and passes between the longitudinal pedal muscles, and the pedal integument.

The pedis retractor posterior muscle (fig. 7, *P.R.P.*) is short and bifurcated at the free end. The bifurcations pass over the anterior part of the posterior adductor muscle. The muscle on reaching the foot continues as the longitudinal pedal muscles.

Alimentary Canal.—The lips (figs. 8 and 9, *A.L.* and *P.L.*), formed by the labial palps, are comparatively wide and project anteriorly.

The oesophagus (fig. 8 and 9, *Oe.*) is of medium length, proceeds posteriorly, and opens into the oesophageal part of the stomach, The oesophageal division (figs. 8 and 9, *Oe. St.*) is long and narrow, and dorsally is almost completely separated from the cardiac division by a thick muscular tissue (figs. 8 and 9, *Oe. C.R.*) passing right across the stomach, while on the left side, at the posterior end, is the central division fig. 8, *C.D.*). The cardiac division (figs. 8 and 9, *C. St*) lies dorsally to the oesophageal one, and on the left side is separated from the pyloric division by the ridge of the central division and another ridge proceeding dorsally from the muscular papilla (fig. 8, *M.P.*). On the right side of the stomach of the specimen examined the separation of the oesophageal, cardiac, and pyloric divisions from each other is not so clearly defined. The pyloric division (figs. 8 & 9, *P.St.*) at its posterior end, continues as the caecum of the cystalline style, (figs. 8 and 9, *C.C.*). It is large and long, passing with a large curve, first ventrally, then anteriorly, and terminating near the dorsal surface of the pedal cavity.

The intestine (fig. 7, *In*) leaves the pyloric division slightly to the right of the anterior side of the cæcum of the crystalline style. It forms a large number of folds ventrally to the stomach, and, in a more or less folded condition, passes along the dorsal surface of the caecum, returning along its ventral surface, then, taking a large curve goes to the dorsal side of the pyloric division, makes on it a large loop, and, turning posteriorly, proceeds as the rectum (fig. 7, *R*) It terminates at the posterior side of the posterior adductor muscle with a bi-lobed anus (fig. 7, *A.*).

The liver (fig. 7, *L.*) lies closely to the stomach extending down the sides and along the greater portion of oesophagus, but the mass of it is underneath the stomach. The large bile-duct enters the central division, and the smaller one on the ventral surface of the oesophageal division, under the muscular ridge separating it from the cardiac division.

Nervous system.—The cerebro-pleural ganglia are situated close to the ventral integument, laterally to the mouth. They are joined to each other by a commissure running just in front of the mouth. Anteriorly each ganglion gives rise to only one anterior pallial nerve, which passes along the ventral integument, then under the anterior adductor muscle to the mantle lobe. Posteriorly the ganglion gives off the cerebro-pedal and cerebro-visceral connectives, the latter passes between the viscera and the pedal integument to the retractor pedis posterior muscle, penetrates its wall, and, emerging, goes along the ventral surface to a viscero-parietal ganglion.

The viscero-parietal ganglia are situated anteriorly to the posterior adductor muscle, and between the bifurcations of the retractor pedis posterior muscle. The branchial nerves run laterally direct to the gills. Each ganglion apparently gives rise to one posterior pallial nerve, which passes along the ventral surface of the posterior adductor muscle to the proximal portion of the siphon. There do not seem to be so many large branches as in *S. strigillatus*. It is not possible to make out the pedal ganglia or the circumpallial nerves.

Circulatory system.—The heart is situated over the protractor pedis posterior muscle, more posteriorly than in *S. strigillatus*.

On the structure of the gills of *Solen* Ridewood states that "in the five species of *Solen* examined the lamellae are heterorhabdic and plicate, the plication being shallower in *Solen orientalis* than in the others. The numbers of filaments in a plica are nearly the same in the two demibranchs and run approximately 26 in *Solen vagina* 17 in *Solen ensis*, 12 in *Solen jonesi*, 22 in *Solen* (*Solena*) *rudis* and 16 in *Solen* (*Pharella*) *orientalis*. In *Solen rudis* alternate interlamellar septa fail to reach more than half-way up the demibranch, but in all the other four species rise high."

EXPLANATION OF PLATE X.

Fig. 1. *Solecurtus dombeyi*, Lam. View from the right side, showing the alimentary canal, &c. Natural size.

Fig. 2. „ „ Longitudinal section of the stomach, showing internal structure of the left side. × 1½.

Fig. 3. „ „ Longitudinal section of the stomach, showing internal structure of the right side. × 1½.

Fig. 4. *Solen corneus*, Lam. External view of the anterior end of the right mantle lobe.

Fig. 5. *Solen gouldi*, Conr. External view of the anterior end of the right mantle lobe.

Fig. 6. *Cultellus javanicus*, Lam. View from the right side, showing the alimentary canal, &c. Natural size.

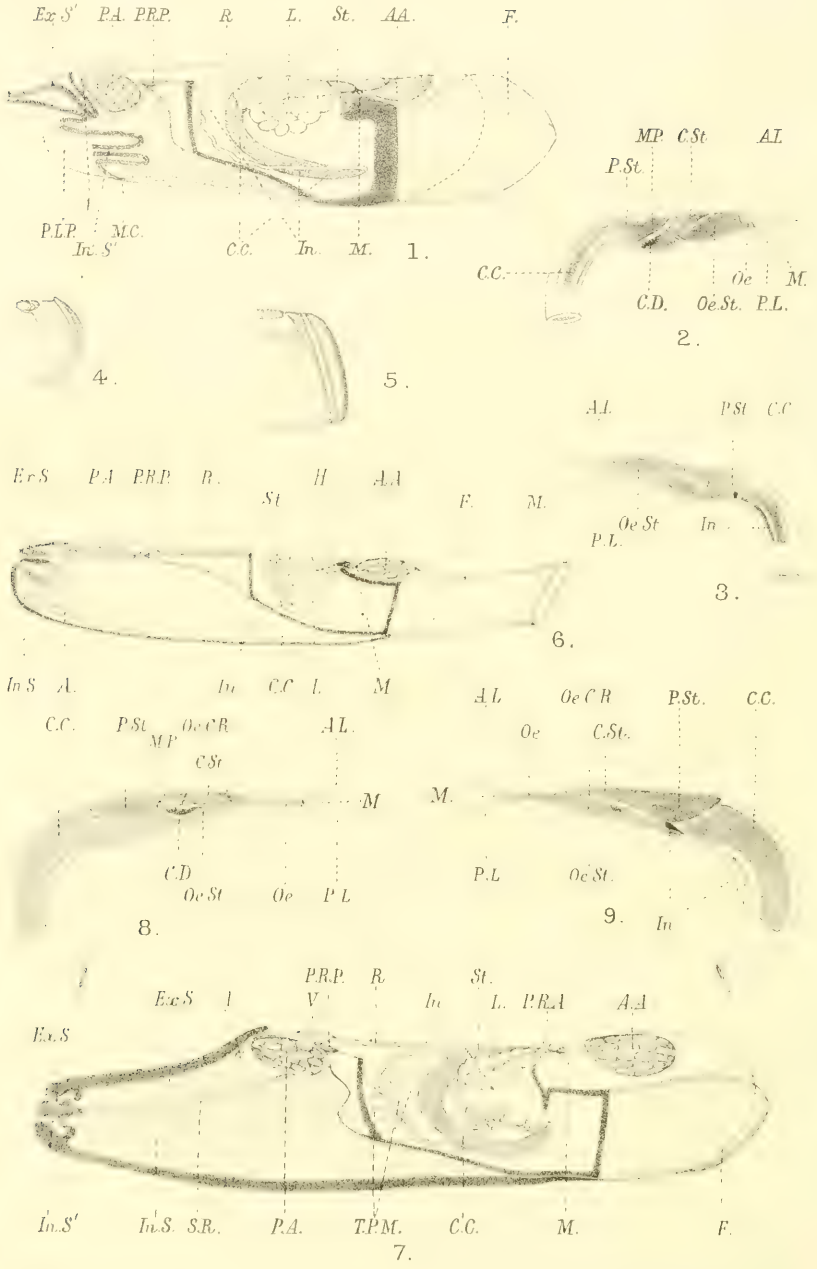
Fig. 7. *Solen* (*Solena*) *rudis*, C. B. Adams View from the right side, showing the alimentary canal, &c. Natural size.

Fig. 8. „ „ Longitudinal section of the stomach, showing internal structure of the left side. × 2.

Fig. 9. „ „ Longitudinal section of the stomach, showing internal structure of the right side. × 2.

REFERENCE LETTERS.

A.	Anus.
A.A.	Anterior adductor muscle.
A.L.	Anterior or upper lip.
C.C.	Caecum of crystalline style.
C.D.	Central division of the stomach.
C. St.	Cardiac division ot the stomach.
Ex. S.	Proximal portion of the exhalent siphonal chamber.
Ex. S'.	Representing the part present of the free portion of the exhalent siphonal chamber.
F.	Foot.
In.	Intestine.
In. S.	Proximal portion of the inhalent siphonal chamber.
In. S'.	Representing the part present of the free portion of the inhalent siphonal chamber.
L.	Liver.
M.	Mouth.
M.P.	Portion of muscular ridge representing the muscular papilla of *Solen* and *Ensis*.
Oe.	Oesophagus.
Oe. C.R.	Muscular ridge separating the oesophageal from the cardiac division of the stomach.
Oe. St.	Oesophageal division of the stomach.
P.A.	Posterior adductor muscle.
P.R.A.	Retractor pedis posterior muscle.
P.L.	Posterior or lower lip.
P. St.	Pyloric division of the stomach.
R.	Rectum.
S.R.	Ridge dividing the inhalent from the exhalent chamber of the proximal portion of the siphon.
St.	Stomach.
T.P.M.	Transverse pedal muscles.
V.	Ventricle.



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ANATOMY OF CERTAIN SPECIES OF SOLENIDAE.

ANATOMY OF VARIOUS SPECIES OF SOLENIDAE: ADDENDA ET CORRIGENDA.

By H. H. BLOOMER.

Journ. Malac., 1901, Vol. viii, page 37, line 1, for "its widest part," read "its deepest part."

Line 24, for "siphonal chambers are short," read "siphonal chambers are very short."

Line 25, "and at the distal end of each chamber are two flaps forming the valve." This applies more particularly to *S. vagina (marginatus)* as these valves are not at all pronounced in *E. ensis* and *E. siliqua.*

Page 38, line 36, for "a circular growth" read "an elliptical growth."

Line 39, for "the circular muscular arrangement" read "the elliptical muscular arrangement."

Page 40, line 41, "and pass underneath instead of over the longitudinal muscles"—that is, viewed from the pedal cavity; actually, they pass between the longitudinal muscles and the pedal integument.

Page 98, paragraphs 2 and 3, for "viscero-parietal ganglion" read "viscero-parietal ganglia" in all three cases.

Journ. Malac., 1902, Vol. IX, page 134, line 25, "and pass underneath instead of over the longtitudinal muscles." This means, as viewed from the pedal cavity, correcting speaking, they pass between the longitudinal muscles and the pedal integument.

Page 135, line 4, for "distal" read "proximal."

Journ. Malac., 1903, Vol. x, page 31, line 10, for "and proceed posteriorly" read "and on the dorsal surface proceed posteriorly."

Line 24, for "tentacular" read "crenulated."

Page 32, line 6, for "pass round the anterior end," read "pass from the dorsal surface around the anterior end."

Line 24, after *S. marginatus*, add, "that is, as viewed from the pedal cavity, but correctly described should be, between the longitudinal muscles and the pedal integument."

Line 25, for "retractor pedis posterior muscles are longer," read "retractor pedis posterior muscle is longer."

Page 33, line 26, for "wide" read "deep" and for "width" read "depth."

Page 34, line 27, for "width" read "depth."

Page 34, lines 28 to 31. It was after writing this sentence that I saw the article by Prof. H. Von Ihering (The Musculus cruciformis of the Order Tellinacea*), and this muscle is evidently a modified form of his musculus cruciformis.

* Proc. Acad. Nat. Sc. Philad., 1900, pp. 480—481, 2 figs.

Page 35, line 33, for "over the inner longitudinal muscles" read "inside the inner longitudinal muscles." They are thus exposed when viewed from the centre of the foot.

Page 37, line 34, for "it apparently altogether disappears" read "they apparently altogether disappear."

Line 37, for "the gland" read "a gland."

Page 40, In explanation for 'S.R." read "siphon" for "stomach."

Page 41, line 18, after longitudinal muscles" add "that is, between the longitudinal muscles and the pedal integument."

Page 42, line 5, after "longitudinal ones" add "that is, between the longitudinal muscles and the pedal integument."

Page 42, line 32, for (*C. magnus*) read (*S. laeteus*, Speng).

Page 115, Line 29, for "over instead of under the longitudinal pedal muscles" read "inside instead of outside the longitudinal pedal muscles." This also applies to the pedis retractor anterior muscles on page 119, line 14.

Page 118, line 21, add "The free portions are transversely finely ribbed, both internally and externally, and internally they also show fine longitudinal ribbing.

Page 118. Respecting the description of the musculus cruciformis, another closer examination proves it to be a diminished example of the one present in *S. strigillatus* and similar to the one found in *S. dombeyi*, with the posterior portions of it very much shortened.

NOTE.

Limnaea parva.—I observe that Caziot, in his recent (1903) account of the mollusca of Corsica, has proposed *Limnaea parva* as a new name for *L. parvula*, Locard, preoccupied. There is, however, a much earlier *L. parva*, Lea, found in America, and just now re-established by Mr. F. C. Baker as a valid species. The European species, if considered valid, must have another name.

T. D. A. Cockerell.

CURRENT LITERATURE.

Iconographia Molluscorum Fossilium in tellure Tertiaia Hungariae, Croatiae, Slavoniae, Dalmatiae, Bosniae, Herzevegoviae, Serbiae, et Bulgariae inventorum. Edidit S. Brusina. . . . Atlas (xxx tabularum . . . volumen). 4°. Agram, 1902.

When Dr. C. L. F. Sandberger was publishing between 1870 and 1875 his monumental work "Die Land-und Süsswasser-Conchylien der Vorwelt," the Tertiary beds of south-eastern Europe were practically unexplored and their fossil conchology unknown. Since then, almost entirely thanks to Prof. Brusina, a wonderful assemblage of fossil shells from that district has been revealed to students.

Among the more important of Prof. Brusina's works is the one of which the alternative title in French reads: "Matériaux pour la faune malacologique néogène de la Dalmatie, de la Croatie," &c.

This was published in 1897 by the Jugoslavenska Akademija znanosti i umjetnosti at Agram. It contained 21 plates accompanied by short letterpress descriptions of the species figured.

The present work is considered by the author as the second part of that publication. It consists of 30 plates accompanied simply by explanations of the figures, while for descriptions the student is referred to the author's previous publications. This is unfortunate, for the lack of descriptions detracts considerably from the value of the book, but, as the author explains in his preface, "Omnis viribus contendam, ut primo quoque tempore conchyliorum descriptionem conficiam, sed exsistit quaestio subdifficilis, num subsidia ad librum divulgandum mihi parare possim." Meantime here are these magnificent plates which cannot fail to be of the utmost interest and use to all interested in the study of conchology, who have it in their power to assist in the solution of the "questio subdifficilis" by their "subsidia."

Among the most interesting forms figured are various species of the happily-named *Orygoceras*, which was discovered and named by Prof, Brusina in 1882. These small shells occur in marls associated with numerous examples of species of *Melanopsis*, and are characteristic of the upper Tertiaries of South-eastern Europe. Their exact affinities are unknown and almost unsurmiseable. Brusina places them in a family by themselves next to the *Otinidae* and to *Valenciennesia*, to which genus despite the very opposite form of the shell he considers it related. Fischer, on the other hand, in his "Manuel" places them doubtfully with the *Valvatidae*. Neither position can be substantiated.

Another abundant form typical of the region is *Congeria*, which is represented by many species, as also is the better-known *Dreissensia*. The latter evidently had its home in this region and spread thence westwards reaching the British area in holocene times, being found fossil at Clifton Hampden, while *Congeria* appears never to have roamed far.

Limnocardium, represented at the present day in the Caspian by the subgenera *Didacna* and *Monodacna* was an abundant form in earlier times, and in some instances came very near to *Cardium* in external form.

Many species of *Unio* are likewise figured, and these exhibit a remarkable diversity of shape, recalling the North-American examples of the present day.

In connection with the theory held by some that the river of the East African great rift valley had its origin in south-eastern Europe, it is interesting to note how some of the species of the *Melanopsis* group here depicted call to mind shells from the great African lakes,

It is to be hoped that the eminent author may ultimately see his way to combining all his scattered observations into one single volume that shall serve as a complement to Sandberger's monograph already cited above.

B. B. WOODWARD.

Reynell, Alexander.—Some account of the Anatomy of *Cassidaria rugosa* (Linn.). Proc. Malac. Soc. Lond., 1905, vol. vi, pp. 292—298, pl. xv, and figs. 2—4, 8, 9, in text.

Mr. Reynell has given an excellent, though all too brief account of the anatomy of this mollusc. The reproduction of the figures, however, are unworthy of the publication and the paper.

Eliot, C.—The Nudibranchiata of the Scottish National Antarctic Expedition. Trans. Roy. Soc. Edinb., 1905, vol. xli, pp. 519—532, figs. 1—20.

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The new species etc., are *Diplodon menziesi*, Gray, n. sub-sp. *incasi*, and *Corneocyclas hodgkini*.

Suter, H.—The first discovered New Zealand *Gundlachia*. Ibid., p. 258.

G. neozelanica, n. sp.

Suter, H.—Revision of the New Zealand species of the Genus *Potamopyrgus*, with descriptions of a new species. Ibid, pp. 259—267, 1 fig.

The new species is *P. subterraneus*. The specimen was obtained by pumping water from a well 48 ft. deep.

Suter, H.—Revision of the New Zealand species of the Genus *Isidora*, with description of a new sub-species. Ibid., pp. 267—276, figs. 1—8.

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EDITOR'S NOTES.

The present number completes the twelfth volume of this Journal, and will be the last.

I regret that I am no longer able to devote the time necessary to editing and publishing the same, and, after very careful consideration, I have decided to cease the publication.

I thank all those malacologists, in different parts of the world, who have requested me to re-consider this decision, but I think it better to devote the time hitherto spent upon the Journal, to my work on the Slugs and Slug-like Molluscs.

To my co-editors (especially Mr. E. R. Sykes), contributors, and subscribers, I offer my sincere thanks for the continued and hearty support they have given me, and I trust that I may still, and for many years to come, retain the honour of their friendship.

INDEX TO VOLUME XII.

P.

R.

S.

S.

T.

Cataulus austenianus, Benson.

Cataulus blanfordi, Dohrn.

In my view *C. connectens,* Fulton (J. Malac., x, p. 102) is only a local race with a yellow peristome: indeed I have specimens, which I am unable to sever from this species, in which the usual dark red peristome is here white.

Cataulus congener, n. sp.

Cataulus colletti, Sykes.

Cataulus decorus, Benson.

Cataulus eurytrema, Pfr.

Cataulus greeni, Sykes.

C. greeni, Sykes: J. Malac., vii, p. 30.

Mr. Fulton has (J. Malac., x, p. 102) described a var. *robusta.*

Cataulus haemastomus, Pfr.

A variety occurs with a white lip.

Cataulus layardi, (Gray) Pfr.

Cataulus marginatus, Pfr.

Mr. Fulton has described (Ann. Nat. Hist., ser. 7, vol. xiii, p. 453) a variety *crenulata.* I take this opportunity of describing a remarkable variety.

Cataulus nevilli, Sykes.

Mr. Fulton has described (l.c.) a var. *flaveolabris.*

Cataulus nietneri, Nevill.

Two varieties, *unicolor* and *caperata,* were recorded by Collett (J. Malac., vol. vii, p. 85).

Cataulus prestoni, n. sp.

Cataulus pyramidatus, Pfr.

The two forms mentioned by Pfeiffer, seem to occur in all collections.

Cataulus rugosus, Fulton.

Cataulus rugosa, Fulton: Ann. Nat. His., ser. 7, vol. xiii, p. 452.

Cataulus smithi, n. sp.

Cataulus sykesi, Fulton.

Cataulus templemani, Pfr.

Cataulus thwaitesi, Pfr.

I am unable to clear up the relationships of this form with the shells described by Pfeiffer under the names of *cumingi* and *duplicatus,* but I incline still to the view that all three are probably varying forms of one species.

DESCRIPTIONS OF THE NEW FORMS.

Cataulus smithi, n. sp.

(Fig. 1.)

Shell deeply rimate, solid, straw-yellow, the protoconch a trifle darker, pyramidal, with the spire well raised; the earlier whorls smooth, and the residue sculptured by numerous, closely set, fine longitudinal costulae; suture well impressed; whorls 8, plano-convex, the last being a little compressed in front; umbilical region large, sculptured as the rest of the shell; the umbilical carina is large and distinct, with a second smaller one within; lip white, continuous, sub-circular, slightly projecting at the base, reflected, most noticeably so at the lower outer margin, canal large.

Alt. 26.5; diam. max. (of last whorl) 10.5 millim.

As compared with *C. aureus* the present shell is straw-yellow and not golden-yellow in colour; it is much larger with flatter whorls, the mouth is sub-circular and lacks the angle at the upper right-hand margin, &c. From *C. austenianus* the shape and colour of the mouth and lip, as also the elongate form, will suffice to sever it; similar variations distinguish it from the white-lipped var. of *C. haemastoma*. I would lay stress on the second carina at the base.

The name is given as a trifling recognition of the assistance that Mr. Edgar Smith has always so readily given me on any difficult point.

1.

Fig. 1.—*Cataulus smithi*, n. sp. × 1½.

2.

Fig. 2.—*Cataulus prestoni*, n. sp. × 1½.

Cataulus prestoni, n. sp.

(Fig. 2.)

Shell nearly related to *C. aureus*, but differing in the following characters. Colour straw-yellow rather than golden-yellow; size smaller; whorls not so inflated; umbilical region more rounded; lip not so produced at the base, not so much reflected, and not so 'winged' at the upper right margin: canal smaller.

Alt. 20.8; diam. max. (of last whorl) 8 millim.

Dedicated to Mr. Preston, in acknowledgment of his courtesy in placing at my disposal all the specimens of *Cataulus* he acquired of Hugh Nevill's.

Cataulus marginatus var. **notata,** n. var.

(Fig. 3.)

Shell larger than the typical form; shape more pyramidal; whorls more flattened; longitudinal striation almost absent; the malleation in the variety is much stronger, especially on the last half of the last whorl, where a second carina, above the normal one, is often present, leaving a smooth area between them; mouth duplex, pale flesh colour.

Alt. 17: diam. max. (last whorl) 5.5 millim.

3.

Fig. 3.—*Cataulus marginatus* var. *notata*, n. var. × 2.

4.

Fig. 4.—*Cataulus congener*, n. sp. × 2.

Cataulus congener, n. sp.

(Fig. 4.)

Shell elongately pyramidal, rimate, yellow, becoming tinged with red-brown on the earlier whorls, these latter are smooth, while the rest of the shell is closely, finely, longitudinally striate; suture well impressed; whorls $7\frac{1}{2}$, convex; umbilical region moderate in size, sculptured as the rest of the shell; aperture sub-circular; lip white, double, the outer part well reflected and thin at the edge, slightly produced at the right upper margin, the inner part circular and produced; basal canal small, the carina being whitish.

Alt. 16.5; diam. max. (last whorl) 6 millim.

Resembling in form a dwarf *C. aureus*, but separable by *inter alia*, the shape of the outer lip, and the duplication of the lip, as also by the small basal canal.

BIONOMICAL CONSIDERATIONS IN GASTROPOD EVOLUTION

By J. R. AINSWORTH DAVIS, M.A.,

Professor of Zoology in the University College of Wales, Aberystwyth.

Without pre-judging the question of Molluscan affinities, or speculating in detail on the characters of the "Archi-Mollusc," there seems good reason for believing that this was a flattened, fairly elongated, creeping type, unsegmented, and probably devoid of an extensive coelom. The creeping habit would be associated with a tendency to increased muscularity of the ventral body-wall, while—as a protective adaptation—the dorsal integument would be more or less strengthened by calcareous secretion. Whatever may have been the exact nature of the "prae-archi-mollusc" it almost certainly respired by the general surface of the body, and as the gradual specialization of both ventral and dorsal surfaces in the manner indicated must have involved a reduction in respiratory efficiency, it is easy to conceive the *pari passu* development—by the selection of favourable variations—of dorso-lateral folds of integument, as a means of compensation. We are thus enabled to construct a plausible hypothesis of the way in which the inception of two primary Molluscan characters—i.e. muscular ventral body-wall and skeletogenous dorsal integument—naturally led to the acquisition of a third characteristic feature—the possession of a *mantle*. The space roofed over by the mantle flaps would be the *mantle cavity*, part of this being destined to deepen into a *branchial cavity* at a later stage in evolution. From some such type as that partially described it is easy to derive the Placophora (*Chiton*, &c.) by further specializations; and perhaps the Aplacophora (*Proneomenia*, *Neomenia*, *Chaetoderma*, &c.) may have arisen from an earlier stage in the evolutionary history of such a type, though the possibility of degeneration must here be taken into consideration.

The lines upon which *Chiton* has evolved have evidently been determined by the habit of clinging to stones, and creeping slowly over their surface to browse upon adherent algae. The comparative length of the foot suggests that it has to do a good deal of creeping, and the observation of living Chitons in aquaria proves that this is actually the case. It is with the upward transitions from the Chiton-type that this article proposes to deal.

Those who have watched the slow progress of a *Chiton*, and compared it with the relatively agile Periwinkle (*Littorina littorea*), cannot fail to have realized that the more primitive animal is undoubtedly delayed in its movements by the fact that shell, viscera, and foot, are all practically co-extensive for the entire horizontal extent of the body. And we can

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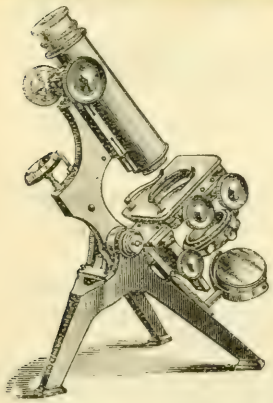

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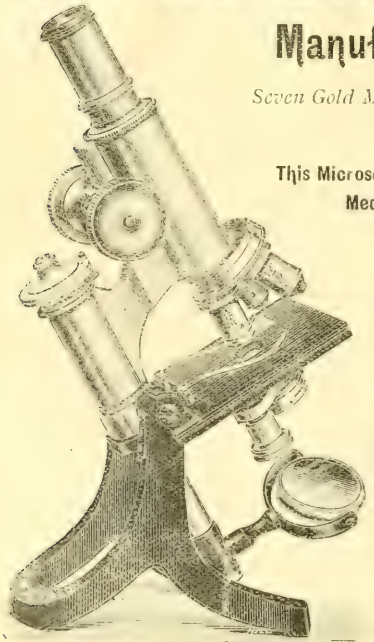

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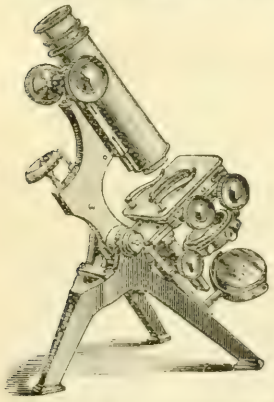

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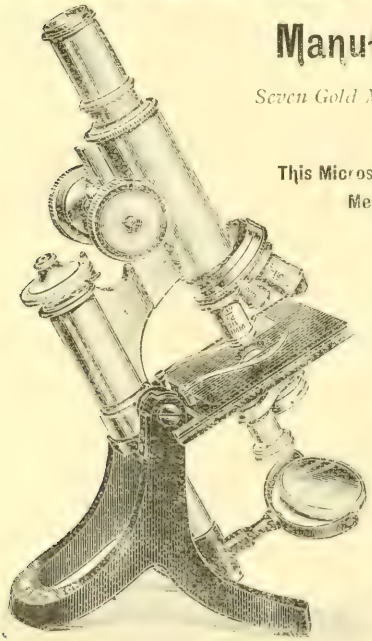

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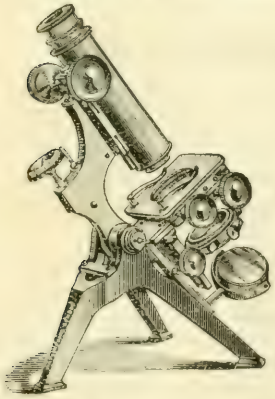

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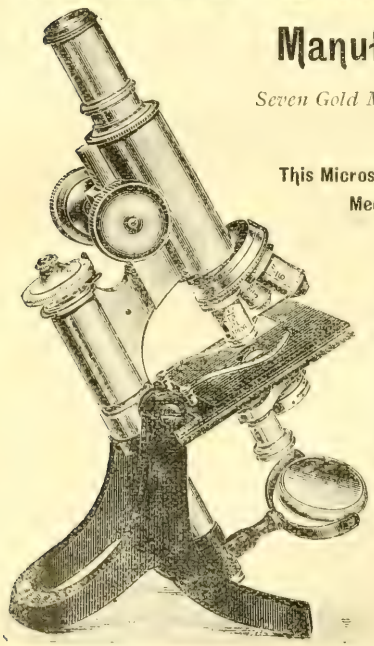

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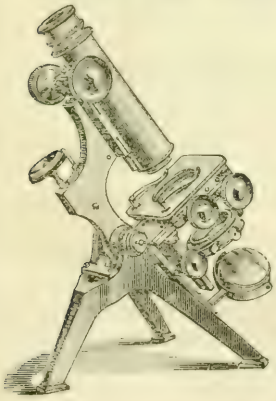

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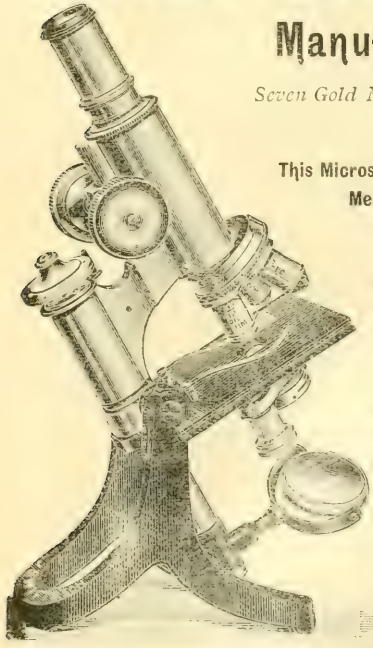

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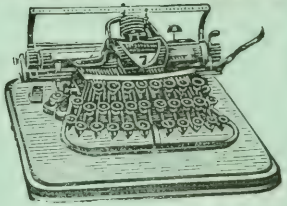

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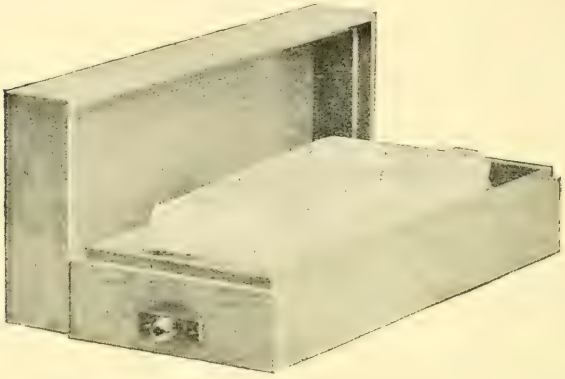

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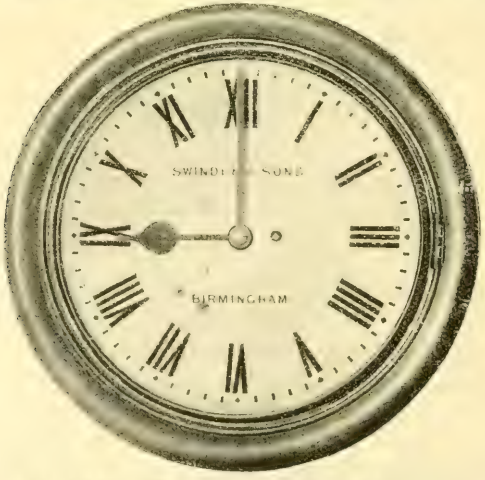

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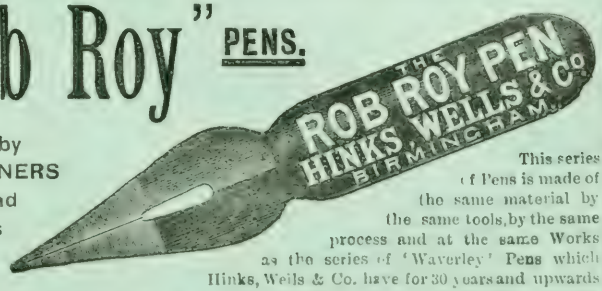

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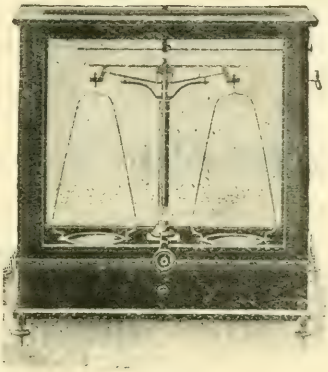

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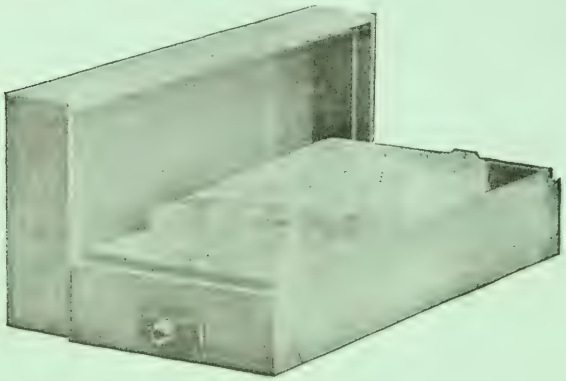

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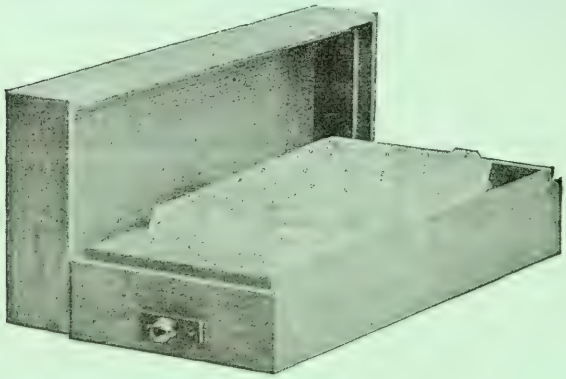

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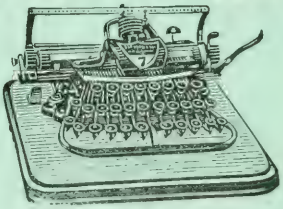

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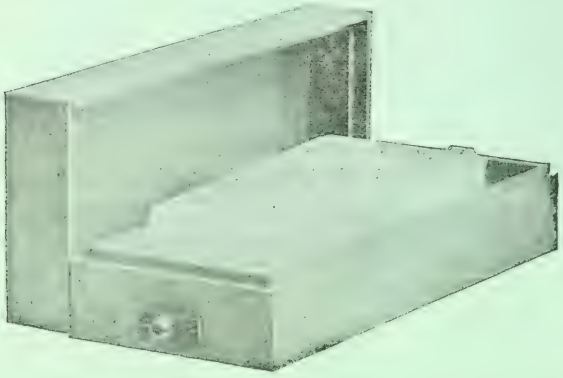

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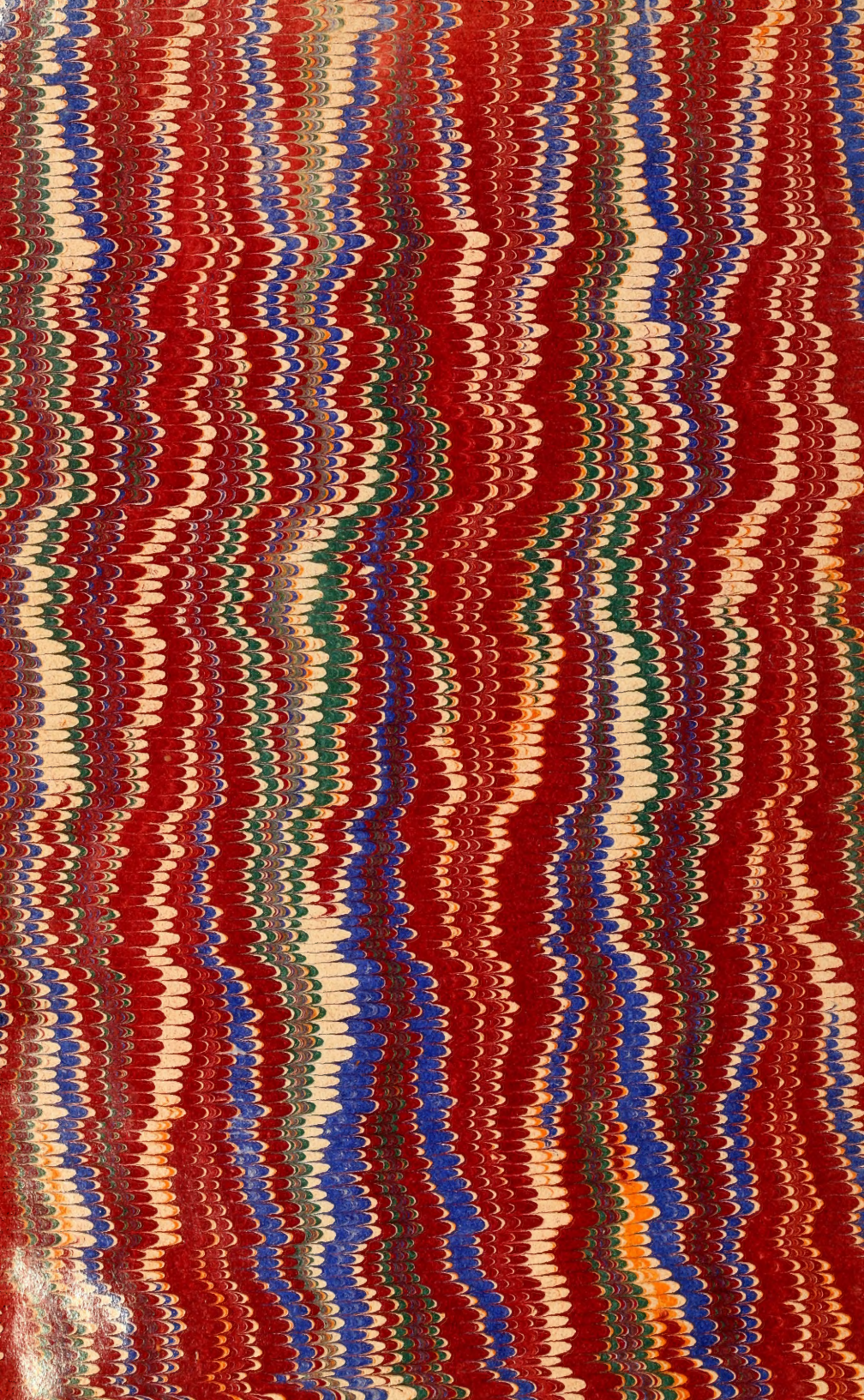

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